TECHNICAL NOISE REPORT

JOINT FEDERAL PROJECT
CONSTRUCTION OF THE CONTROL STRUCTURE AND LINING OF THE SPILLWAY CHUTE AND STILLING BASING SUPPLEMENTAL EA/IS

Folsom Dam, Folsom, California

Prepared for:

US Army Corps of Engineers
Sacramento District, South Pacific Region

Prepared by:

AGEISS INC.

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ACRONYMS AND ABBREVIATIONS

˚F	degrees Fahrenheit
ADT	average daily trips
ANFO	ammonium nitrate fuel oil
ANSI	American National Standards Institute

BACT	best available control technologies
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	decibels, A-weighted scale
DNL	day-night noise level (also L_{dn})
DoD	U.S. Department of Defense
DOT	U.S. Department of Transportation
DPR	California Department of Parks and Recreation
DS/FDR	Folsom Dam Safety/Flood Damage Reduction
EA	Early Approach
EA/IS	environmental assessment/impact statement
EIS/EIR	environmental impact statement/environmental impact report
FHWA	Federal Highway Administration
HT	heavy trucks
Hz	Hertz
ISO	International Standard of Organization
JTF	Joint Task Force
kHz	kiloHertz
$L_{10\text{-}90}$	percentile sound levels ($L_{1.7}$, $L_{8.3}$, L_{10}, L_{50}, and L_{90})
L_{dn}	day-night equivalent noise level (also DNL)
L_{eq}	time-averaged integrated equivalent noise level
L_{max}	maximum sound level
L_{min}	minimum sound level
L_p	sound pressure level (also SPL)
L_w	sound power level
LOR	local ordinances and regulations
LT	light trucks or long-term
LUT	lookup table
msl	mean sea level
MIAD	Mormon Island Auxiliary Dam
MT	medium trucks
NEPA	National Environmental Policy Act
OPR	Governor's Office of Planning and Research
P_{K15}	Peak Noise Level
RCNM	Road Construction Noise Model
SEL	single event level
SP7	SoundPLAN™ Version 7
SPL	sound pressure level (also L_p)
STG	submerged tainter gates
TNM	Traffic Noise Model
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Technical Noise Impact Report (Report) was prepared in support of the Supplemental EA/IS – Folsom Dam Safety/Flood Damage Reduction (DS/FDR) Project (Project). The Report was prepared in general accordance the United States Army Corps of Engineers (USACE) Sacramento District's Performance Statement of Work issued on 14 January 2010, Task Order TO No. 1, Contract No. W91238-09-D-0032-0001, contract and scope modifications made during the kickoff telephone conference on 2 February, 2010, site visit on 17 February, 2010, and our Scope of Work and Proposal dated 29 December 2009.

1.1 Project Description

The federal Joint Task Force (JTF) consists of both the U.S. Bureau of Reclamation and the USACE. Reclamation is responsible for excavating the Stilling Basin and Spillway Chute, and partial excavation of the Auxiliary Spillway Control Structure. The USACE is responsible for lining the excavated Spillway Chute and Stilling Basin, final excavation and construction of the Control Structure, Approach Channel, and other concrete structures.

The auxiliary spillway adjacent to Folsom Dam was selected as the alternative plan to meet the objectives of the Folsom Dam Modification authorized project. The spillway site is located on the left abutment of the main dam, immediately downstream of the existing Left Wing Dam.

The proposed spillway consists of a 1,100-foot-long approach channel into Folsom reservoir, a spur dike, a gated control structure including six submerged tainter gates, a 3,000-foot-long spillway chute, and a stilling basin. Flows from the auxiliary spillway empty into the American River about 1,500 feet downstream of the main dam.

The proposed auxiliary spillway control structure is a reinforced concrete gravity structure about 150 feet high. The control structure is founded on bedrock and comprised of 2 independent flow-through monoliths each 89 feet, 9 inches wide which are flanked by 3 non-flow-through monoliths also keyed into the adjacent rock. Each flow-through monolith houses 3 submerged tainter gate (STG), each 23 feet wide by 34 feet, 0 inches high. Each of the six STGs will have its own dedicated steel bulkhead gate and hoist assembly. Construction elements include excavation, preparation of the foundation, drainage and seepage controls, mass concrete placement, procurement, delivery and installation of the STGs and bulkhead gates, internal and external access, mechanical, electrical and instrumentation controls.

The project will be completed in sequential order as follows:

1. Control Structure Excavation
2. Control Structure Foundation and Concrete Work
3. Installation of the Control Structure Gates
4. Stilling Basin and Spillway Chute Foundation and Backfill
5. Stilling Basin and Spillway Lining and Concrete Work

1.2 Previous Studies

Previous environmental studies prepared for the Folsom Dam Safety and Upgrades include the following:

2003: Draft Resource Inventory, Folsom Lake State Recreation Area

2006: Folsom DS/FDR Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR)

2006: Draft Noise Analysis Report, Folsom Bridge Project, Folsom, California

2008: Finding of No Significant Impact and Final Supplemental Environmental Assessment to the Folsom Dam Safety and Flood Damage Reduction Final Environmental Impact Statement/Environmental Impact Report

2009: Final Joint Federal Project Early Approach Channel Excavation Noise Analysis

Relevant elements of the documents listed above were incorporated into this evaluation in part and referenced. The methodologies used in this evaluation are consistent with, and in some cases improve upon, methods used in these previous documents.

1.3 Objectives and Methodology

The primary objective of this technical noise evaluation is to determine if project operations have the potential to cause significant noise impacts to sensitive receptors within the affected area. This determination is presented for each of the project elements listed previously. Secondary objectives, performed as part of the overall analysis included the following:

1. Discussion of the physical and environmental properties of noise.
2. Identification of sensitive receptors within the affected area.
3. Review ambient noise data collected during the recent Joint Federal Project Early Approach (EA) Channel Excavation Noise Analysis and evaluate applicability to the Project.
4. Evaluate coverage and completeness of the previous noise analysis and ambient noise data collected during preparation of the Folsom DS/FDR EIS/EIR and evaluate applicability to the Project.
5. If required, collect supplemental ambient noise data in the vicinity of previously identified sensitive receptors and newly identified sensitive receptors.
6. Evaluate construction and traffic noise sources identified in construction plans, specifications, and schedules provided by the USACE that may contribute to the calculated day and night average sound level (L_{dn}) baseline using the equivalent noise levels (L_{eq}) in accordance with CNEL periods (day, evening, and night).
7. Classify potential noise impacts to sensitive receptors.
8. Prepare mitigative measures to lessen noise impacts to less than significant levels as defined in the California Environmental Protection Act (CEQA) and National Environmental Policy Act (NEPA).

The methodology used to prepare this report is as follows:

1. Reviewed previously prepared noise impact documents pertaining to the area of work and adjacent areas of work.

2. Obtained via public sources, data and information on the Control Structure, Spillway Chute, and Stilling Basin.
3. Obtained and modeled existing terrain and new topographic features based on #1 and #2 above.
4. Created a 3D model approximation of the Spillway Chute and Stilling Basin prior to lining.
5. Created terrain models of the areas of work by project phase.
6. Prepared Haul Road grading contours to approximately match current construction including the road cut beneath the Boat Launch.
7. Conducted a site visit and area reconnaissance on February 17, 2010 to evaluate:
8. Previously identified sensitive receptors.
9. Any new sensitive receptors that may be potentially impacted by operations for this project.
10. Ground cover, current topography, and mitigative features such as landscaping, tree lines, and ridge lines.
11. Project site conditions and equipment types in use.
12. Human activity in areas adjacent to the project site and farther areas where potential noise impacts should be modeled.
13. Prepared noise models using SoundPLAN 7 (SP7), BNOISE2, TNM 2.5, and RCNM.
14. Compared modeled noise levels to existing ambient noise monitoring data.
15. Determined potential noise impacts.
16. Prepared recommended mitigative measures for project activities.

2.0 FUNDAMENTALS OF SOUND

Perceptible acoustical sensations can be generally classified into two broad categories; sound and vibration.

Sound and Noise

Sound is a disturbance in an elastic medium resulting in an audible sensation. Sound is also defined as mechanical energy transmitted from a vibrating or flowing source by longitudinal (or compression) waves through a compressible medium such as air. The term “noise” is both qualitative and quantitative, and is typically referred to as "unwanted” sound.

Vibration

Vibration is a disturbance in a solid elastic medium, which may produce a detectable motion. This differentiation between sound and vibration is most relevant for environmental noise studies when industrial or construction noise sources produce high energy waves at low frequencies that are below human audible thresholds but match the frequency response of nearby structures. These frequencies are typically less than 31 Hertz (Hz). This energy causes vibrations similar to earthquakes. Sources with audible components in addition to the vibration-producing low-frequency energy are typically heard after initial vibrations start and sometimes end depending on distance from the source.

2.1 Physiological and Physical Parameters

Sound can be further characterized by both physiological and physical parameters. These parameters include the following:

- Loudness, as a subjective or perceived noise level that is a qualitative physiological sensation
- Loudness as a numerical scale, using “A-weighted” decibels and by sones (units of perceived loudness)
- Annoyance from high-energy low-frequency single events. This events have well-documented annoyance factors on nearby human receptors. The percentage of annoyed listeners is dependent on the following conditions (U.S. Army, 2005):
  - Intensity
  - Duration
  - Repetition
  - Abruptness of onset or cessation
  - Background or ambient noise levels
  - Interference with activity
  - Previous experiences within the community
  - Time of day
  - Fear of personal danger from the noise sources
  - Socioeconomic status and education level of the community
  - The extent people believe that the noise could be controlled
- Sound intensity, the average flow of sound energy through a unit area in a sound field. Sound intensity is a vector quantity with both magnitude and direction.
- Frequency spectrum - the rate of oscillation in cycles per second.
- Wavelength, the distance between successive wave compressions and expansions.

- Energy content as sound pressure level, L_p (also written as SPL). The ear responds to sound pressure as sound waves represent oscillations of pressure just below atmospheric pressure (expansion of longitudinal wave) and just above atmospheric pressure (compression). These pressure oscillations cause the inner ear to vibrate. Sound level meters are also sensitive to these oscillations.

In particular, the SPL has become the most common descriptor used to characterize the loudness of an ambient or environmental sound level. Sound pressure is affected by geophysical properties such as air temperature, pressure, humidity, rain or snow, and wind, as well as physical barriers such as terrain, and the walls of structures. Sound energy dissipates with increasing distance from the source due to absorptive surfaces such as grass, trees, and water. Due to these factors, the noise level perceived by a receptor at a certain location depends on the following parameters:

- Distance between the noise source and the receptor.
- Presence or absence of absorptive surfaces.
- The amount of mitigative noise features between the receptor and noise source including intervening terrain, structures, foliage, and ground cover.
- Cumulative noise impacts from reflective surfaces such as building facades, concrete, asphalt, water bodies, etc.
- Current weather conditions (snow, wind, rain) and weather-related ground cover (snow, mud, wet or dry ground).

2.2 Physical Properties of Sound

Sound levels are affected by distance from the source to receiver (propagation) and by localized atmospheric conditions. These are further described below.

2.2.1 Sound Propagation

In an ideal atmosphere without wind, temperature gradients, humidity or ground effects sound levels decay as 6 dB per doubling of distance from a stationary source due to geometrical spreading. If a source generates a level of 90 dBA at 50 feet then geometrical spreading implies a level of 70 dBA at a distance of 500 feet from the source. If the source is moving, then the maximum level will obey the same relationship, but the exposure time is also a function of sideline distance. For a moving source the time averaged integrated level (L_{eq}) will decay as 3 dB per doubling of sideline distance (cylindrical spreading), providing the integration time is the constant and extends until the sound level has decayed to 10 dB below its peak level. In this case, if a source generates a L_{eq} of 70 dBA during a drive by in which the source passes 50 feet from the observer at its closest point, then the L_{eq} at 500 feet will be 60 dBA. These simple scaling laws are modified in reality by local atmospheric propagation effects. At low wind speeds and at distances of less than 100 feet atmospheric propagation effects are small and can be ignored. At larger distances atmospheric propagation will modify the decay of the sound level with distance. In addition, ground effects can be important at small distances from the source and will depend on the ground cover and the height of the source and receiver above the ground.

Figure 2-1 provides a range of noise levels in the ideal atmosphere. Additionally, color shading delineates the threshold of pain (purple), noise levels that would typically exceed regulatory thresholds (red) and noise levels that may exceed regulatory thresholds depending on time of day and time-weighting (yellow). Noise levels are typically within (white) or below (green) regulatory thresholds.

Figure 2-1: Noise Level Attenuation Due to Geometric Spreading in an Ideal Atmosphere

Sound Power Level (L_w) of Noise Source (dB*)	Distance from Noise Source to Outdoor Receiver (Feet)											
	1	2	4	8	16	32	64	125	250	500	1000	2000
	Sound Pressure Level (Lp)											
150	144	138	132	126	120	114	108	102	96	90	84	78
140	134	128	122	116	110	104	98	92	86	80	74	68
130	124	118	112	106	100	94	88	82	76	70	64	58
120	114	108	102	96	90	84	78	72	66	60	54	48
110	104	98	92	86	80	74	68	62	56	50	44	38
108	102	96	90	84	78	72	66	60	54	48	42	36
106	100	94	88	82	76	70	64	58	52	46	40	34
104	98	92	86	80	74	68	62	56	50	44	38	32
102	96	90	84	78	72	66	60	54	48	42	36	30
100	94	88	82	76	70	64	58	52	46	40	34	28
98	92	86	80	74	68	62	56	50	44	38	32	26
96	90	84	78	72	66	60	54	48	42	36	30	24
94	88	82	76	70	64	58	52	46	40	34	28	22
93	87	81	75	69	63	57	51	45	39	33	27	21
92	86	80	74	68	62	56	50	44	38	32	26	20
91	85	79	73	67	61	55	49	43	37	31	25	19
90	84	78	72	66	60	54	48	42	36	30	24	18
89	83	77	71	65	59	53	47	41	35	29	23	17
88	82	76	70	64	58	52	46	40	34	28	22	16
87	81	75	69	63	57	51	45	39	33	27	21	15
86	80	74	68	62	56	50	44	38	32	26	20	14
85	79	73	67	61	55	49	43	37	31	25	19	13
84	78	72	66	60	54	48	42	36	30	24	18	12
83	77	71	65	59	53	47	41	35	29	23	17	11
82	76	70	64	58	52	46	40	34	28	22	16	10
81	75	69	63	57	51	45	39	33	27	21	15	9
80	74	68	62	56	50	44	38	32	26	20	14	8
79	73	67	61	55	49	43	37	31	25	19	13	7
78	72	66	60	54	48	42	36	30	24	18	12	6
77	71	65	59	53	47	41	35	29	23	17	11	5
76	70	64	58	52	46	40	34	28	22	16	10	4
75	69	63	57	51	45	39	33	27	21	15	9	3
74	68	62	56	50	44	38	32	26	20	14	8	2
73	67	61	55	49	43	37	31	25	19	13	7	1
72	66	60	54	48	42	36	30	24	18	12	6	0
71	65	59	53	47	41	35	29	23	17	11	5	
70	64	58	52	46	40	34	28	22	16	10	4	
69	63	57	51	45	39	33	27	21	15	9	3	
68	62	56	50	44	38	32	26	20	14	8	2	
67	61	55	49	43	37	31	25	19	13	7	1	
66	60	54	48	42	36	30	24	18	12	6	0	
65	59	53	47	41	35	29	23	17	11	5		
64	58	52	46	40	34	28	22	16	10	4		
63	57	51	45	39	33	27	21	15	9	3		
62	56	50	44	38	32	26	20	14	8	2		
61	55	49	43	37	31	25	19	13	7	1		
60	54	48	42	36	30	24	18	12	6	0		

Notes: *Lw Reference of 10E-12 Watts

2.2.2 Effects of Local Atmospheric Conditions

During periods of strong sunshine the ground surface temperature is increased and this causes heating of the lower atmosphere. These conditions cause the air temperature to decrease with height which is referred to as a temperature lapse. When a temperature lapse exists sound rays are refracted upwards and a shadow zone is formed a few hundred feet from the source (Glegg 2005). In contrast during the night time hours there is significant cooling of the ground and the atmospheric temperature increases with height, causing a temperature inversion. This causes sound to be trapped in the lower atmosphere and sound levels can exceed those expected from spherical spreading. Furthermore, focusing effects can occur from temperature inversions and higher sound levels may be observed in a local area at relatively large distances from the source (Hubbard 1995).

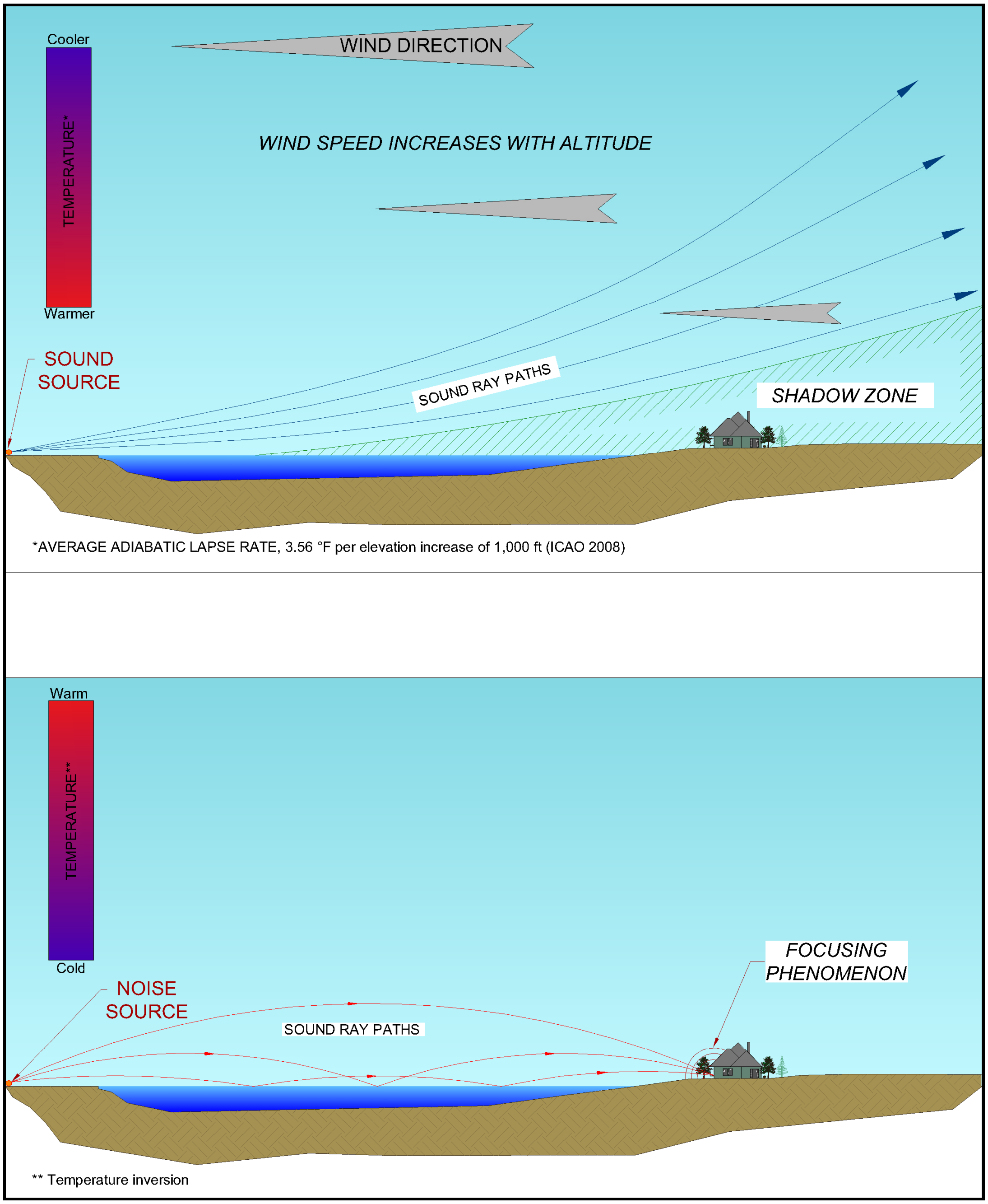
Wind gradients close to the ground can cause the same effects as temperature gradients. Sound propagating upwind is refracted upwards and forms a shadow zone. Sound propagating downwind is refracted downwards and is louder than expected (Hubbard 1995). Sound is also attenuated by molecular absorption as it propagates. This is a strong function of humidity and frequency and standard curves are available to make corrections for atmospheric absorption of this type. Typically excess attenuations of 5 dB per 1,000 feet of propagation can be expected at 2 kiloHertz (kHz) for a relative humidity of 50-90 percent and temperatures over 60 degrees Fahrenheit (˚F) (Beranek 1971).

An example of excess attenuation over a lake in Europe shows an additional 2-5 dB of attenuation per kilometer over and above atmospheric absorption. Sound level measurements from this study also show that a shadow zone can be formed by a temperature lapse. At a distance of 650 feet in the downwind direction sound levels exceed expected values at 250 Hz by 1 dB, but in the upwind direction the levels are 10 dB lower than expected (Beranek 1971).

2.2.3 Ground Effects

When a source and/or receiver are placed aboveground an interference effect takes place that modifies the measured sound level. At very low frequencies the spectral levels are increased by 6 dB (at all distances) and at higher frequencies a series of interference dips occur where the spectral level is reduced to zero. When the source and receiver are 4 feet above ground and separated by 50 feet over a hard surface, the first interference dip occurs at 439 Hz. At a source and receiver separation of 300 feet the first separation dip occurs at 2,636 Hz. The ground effect increases the dBA level by 3 dB over a free field level (i.e., the level that would occur if the ground were not present) for a broadband source when the interference dip is at a frequency of approximately 1,000 Hz or less. When the frequency of the first ground interference dip exceeds 20 kHz, then the dBA level is increased by 6 dB relative to the free field level. For propagation over hard surfaces the ground effect, therefore, reduces the geometrical spreading loss of the dBA level when the source and receiver are less than 2,400 feet apart. This effect is relatively small unless propagation takes place over soft ground cover, in which case the effect of ground absorption can be significant. Figure 2-2 illustrates the shadow zone created by a downwind noise source (upper portion), and also illustrates the focusing phenomena created by temperature inversion, upwind noise source, and ground/water surfaces (lower portion).

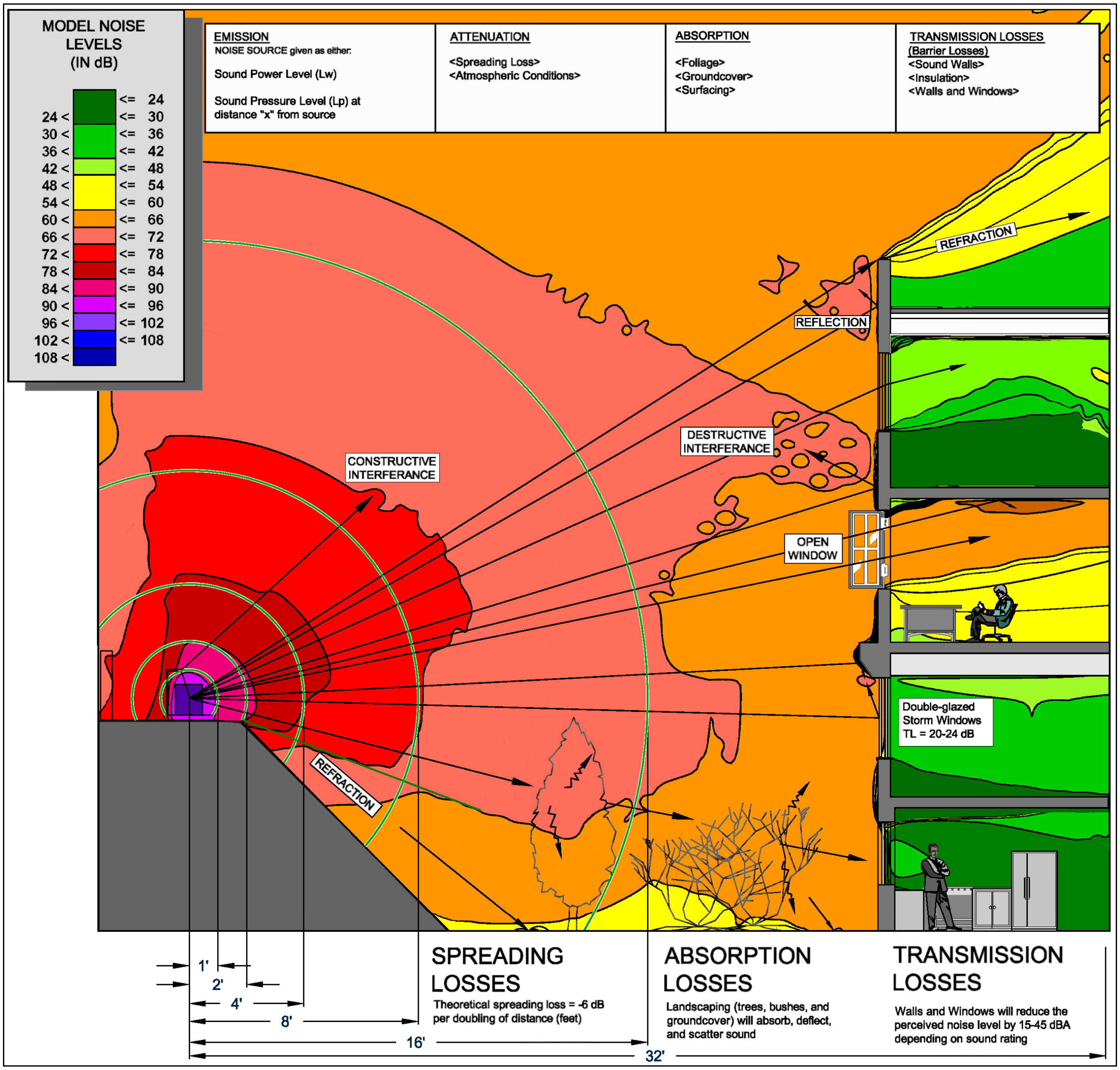
Figure 2-2: Ground Effect, Wind and Temperature Inversion Graphic



2.2.4 Reflection, Refraction, Absorption, and Transmission Losses

The sound level measured at a specific location at a discrete time is the sum of all noise source SPLs that converge at that point. Sound will refract around hard edges, be absorbed by foliage, structural materials, and the various atmospheric conditions previously described. Reflection will occur at hard surfaces where sound is not completely absorbed and/or scattered. Sound that reflects back to a source is called an echo. Transmission loss through structural materials such as walls and windows reduce sound pressure the most. Figure 2-3 illustrates these concepts.

Figure 2-3: Emission, Attenuation, Absorption, and Transmission Loss Graphic



2.2.5 High-Energy Impulsive and Low Frequency Noise

A set of guidelines developed by the Naval Surface Warfare Center, Dahlgren, Virginia, is used to evaluate the complaint potential from low-frequency sound (impulsive noise) that is caused by activities such as detonating explosives and artillery firing (Pater, 1976).

2.2.6 Sound Level Measurement

The dB scale is used to quantify sound intensity. Because SPLs can vary by over 1 million times within the range of human hearing, a logarithmic loudness scale (similar to the Richter Scale used for earthquake intensity) is used to keep sound intensity numbers within a manageable range. Since the human ear is not equally sensitive to all sound frequencies within the entire spectrum, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity (middle A and its higher harmonics) in a process called "A-weighting," written as dBA.

Noise measurement metrics used for this analysis are as follows:

- Equivalent sound level (L_{eq}), the average sound level calculated from instantaneous measurements recorded over a specific period of time.
- Maximum sound level (L_{max}) reached during a sampling period. The L_{max} value is the peak noise level that occurred during the measurement period.
- Minimum sound level (L_{min}) reached during a sampling period. The L_{min} value obtained for a particular monitoring location typically reflects ambient conditions.
- Percentile sound levels (L_{90}, L_{50}, and L_{10}) are sound levels that exceed the percentile value during the measurement period.
- Community Noise Equivalent (CNEL): the average of the daytime measurement, evening measurement +5 dBA, and the night measurement +10 dBA.
- Single Event Level (SEL): Used for blasting events that are less than a minute in duration, when energy average noise values do not provide accurate depiction of the maximum noise levels produced by the single event.
- Peak Noise Level (P_{K15}): Unweighted peak sound levels or maximum sound levels that assess maximum noise levels during single-noise events. This is necessary when the DNL (average) noise measurements might understate the severity of a single-noise event. Sometimes annoying noise peaks can be "averaged out." Unweighted peak measurements, with no time averaging, are a good predictor of complaints.
- Day Night Level (L_{dn}): The day-night sound level (DNL) evaluator is recommended by the Environmental Protection Agency and used by most federal agencies as a land-use planning tool. It describes the average daily acoustic energy over the period of one year—meaning that moments of quiet are averaged together with moments where loud noises can be heard. The Department of Defense (DoD) uses DNL because it incorporates a "penalty" for nighttime noise (normally 10:00 p.m. to 7:00 a.m.) when loud sounds are typically more annoying.

2.2.7 Community Noise Levels

Community noise levels depend on the intensity of nearby human activity. Noise levels are generally considered low when ambient levels are below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA. In rural and undeveloped areas, L_{dn} can be below 35 dBA. Levels above 75 to 80 dBA are more common near major freeways and airports. Although people often accept the higher levels associated with very noisy urban areas, they nevertheless are considered to be adverse to public health. California uses a stricter equivalent sound level definition, which uses the L_{dn} and adds a 5-dB penalty to sound measurements between 10:00 PM and 7:00 AM.

2.2.8 Noise Level Acceptance Criteria

The surrounding land uses dictate what noise levels would be considered acceptable or unacceptable. In rural and undeveloped areas away from roads and other human activity, the day-to-night difference is normally small. Because of diurnal activity, nighttime ambient levels in urban environments are about 7 dB lower than the corresponding daytime levels. Nighttime noise is a concern because of the likelihood of disrupting sleep. Noise levels above 45 dBA at night can result in the onset of sleep interference. At 70 dBA, sleep interference effects become considerable (USEPA 1974).

2.3 Noise Sources

Environmental noise sources are segregated into four categories: single event, mobile, stationary-temporary, and stationary-permanent. Examples of noise sources in each of the two categories with A-weighted sound levels are presented in Table 2-1 below. Construction noise sources are always temporary, and are typically mobile, but may be stationary or single event. Construction noise sources are provided in more detail in Table 2-2. Acoustical terminology definitions are provided in Appendix A.

Table 2-1: Typical Stationary and Mobile Noise Source Sound Levels in dBA

Noise Source	Sound Level in dBA	Category
Noise at ear level from rustling leaves	20	STATIONARY-TEMPORARY
Room in a quiet dwelling at midnight	32	STATIONARY
Soft whisper at 5 feet	34	STATIONARY-TEMPORARY
Large Department Store	50 to 65	STATIONARY-TEMPORARY*
Room with window air conditioner	55	STATIONARY-PERMANENT
Conversational Speech	60 to 75	STATIONARY
Pump Station Equip. with Noise Abatement	62	STATIONARY-PERMANENT
Passenger Car at 50 feet	69	MOBILE
Vacuum cleaner in private home at 10 feet	69	STATIONARY
Ringing alarm at 2 feet	80	STATIONARY
Roof-top Air Conditioner	85	STATIONARY-PERMANENT
Bulldozer at 50 feet	87	MOBILE
Heavy city traffic	90	MOBILE
Home lawn mower	98	MOBILE
Jet aircraft at 500 feet overhead	115	MOBILE
Human pain threshold	120	NA
Construction Blast**	120 to 145 at 50 feet	SINGLE EVENT

Notes and References:
* Time-of-day dependent
Reference: Noise Control Reference Handbook, Industrial Acoustics Company

2.3.1 Construction Noise

Construction noise sources and corresponding noise levels in the project area will greatly fluctuate depending on the purpose of construction and the particular type, number, and duration of use of various types of construction equipment involved. The effect of construction noise on nearby receptors depends upon how much noise is generated by each individual piece of equipment, the distance between construction activities and the nearest noise-sensitive receptors, the frequency, type, and duration of noise produced, and the ambient noise levels at the receptors. Typical construction equipment noise levels at 50 feet are summarized in Table 2-2. Construction noise modeling is discussed in the next section.

At a distance of 50 feet, noise levels would be between 68 to 96 L_{eq}. Noise levels would be correspondingly higher at receptor sites located closer to construction activities. Noise levels in this range would be substantially higher than the ambient noise levels experienced by sensitive receptors in typical rural commercial, recreational, and residential environments. In many areas along the proposed project transportation routes, staging areas, and potential construction zones, intervening topography, trees, and foliage may provide some noise attenuation.

Table 2-2: Construction Noise Sources by Octave Band Spectra

	Sound Power Levels (dB) by Octave Band Center Frequency (Hertz)								
Noise Source	63	125	250	500	1000	2000	4000	8000	A-Weighted Total Sound Power (dBA)
Large Dozer	110	122	113	114	110	108	104	94	116
Large Motor Grader	99	105	103	98	97	94	88	79	102
Large Excavator	107	114	107	106	103	101	94	88	109
80-Ton Crane	104	110	108	103	102	99	93	84	107
Large Dozer-Ripper	110	122	113	114	110	108	104	94	116
40 TN Articulated Trucks	102	108	106	101	100	97	91	82	105
Dozer	110	122	113	114	110	108	104	94	116
Rock Drills	109	118	113	113	113	112	110	104	118
Powder Truck	102	108	106	101	100	97	91	82	116
Drill Rig	100	106	104	99	98	95	89	80	103
Diesel Generator Exhaust Discharge	109	114	109	104	94	84	81	71	105
Diesel Generator Gas Discharge	97	99	102	103	102	104	99	100	109
Large Front End Loader	112	124	114	110	108	106	102	90	115
Self-Propelled Vibratory Roller	102	108	110	106	102	100	98	90	109
On-Highway Transportation Trucks and Trailers	102	108	106	101	100	97	91	82	105

Notes: Source: DS/FDR Early Excavation Supplement EA/IS. 2009

2.3.2 Traffic Noise Sources

Traffic noise predictions are based on vehicle classification, the number of each vehicle per day as average daily trips (ADT), or by hour, and the speed of each vehicle type. These parameters are defined by the Federal Highway Administration (FHWA). Vehicle classification includes heavy trucks (HT), medium trucks (MT), light trucks (LT), automobiles, buses, and motorcycles.

2.3.3 Critical and Sensitive Receptors

Some land uses are generally regarded as being more sensitive to noise than others due to the types of population groups or activities involved. The definition of critical and sensitive receptors varies by jurisdiction, but in general, critical receptors are those that cannot be interrupted or disturbed by project noise. This include, but are not limited to, police and fire stations, high security operations, noise-sensitive industry, hospitals, nursing homes, and other long-term medical care facilities. Sensitive population groups include children and the elderly and sensitive land uses. These include residential (single- and multi-family, mobile homes, dormitories, and similar uses), guest lodging, parks and outdoor recreation areas, schools, libraries, churches, and places of public assembly. No critical receptors were identified. The sensitive receptors identified for this project are listed by general area on Table 2-3 below. Additional specific locations within each area that were evaluated are shown in the noise modeling results section. Corresponding construction phases of potential concern and the distance from each sensitive receptor to the long-term ambient monitoring points are also listed. Sensitive receptors and the long-term monitoring locations are also illustrated on Figure 2-4.

Table 2-3: Sensitive Receptors

Receptor Type	Map ID (Figure 2-3)	Receptor Name, Location, and/or Address	Project Phase and Operation of Potential Concern	Long-Term Ambient Noise Monitoring Location ID
RESIDENTIAL	R-1	Lake Pointe Apartments	Phase 1 and 5	LT-6
RESIDENTIAL	R-2	Folsom Prison – North Buildings	All Phases	LT-1
RESIDENTIAL	R-3	Mountain View Drive Residences	All Phases	LT-3
RESIDENTIAL	R-4	Christina Court Residence	Phase 1, 2, and 5	LT-2 and LT-3
RESIDENTIAL	R-5	Lorna Lane Residences	Phase 1, 2, and 5	LT-2 and LT-3
RESIDENTIAL	R-6	Amaya Drive Residence	Phase 1, 2, and 5	LT-2
RESIDENTIAL	R-7	East Natoma Drive Residences	MIAD only	LT-4
RESIDENTIAL	R-8	Singer Lane Residences	MIAD only	NA
RESIDENTIAL	R-9	Ballau Circle Residences	MIAD only	LT-4
RESIDENTIAL	R-10	Church Grounds north of East Natoma Drive	MIAD only	NA
COMMERCIAL / RETAIL	CR-1	East Natoma and Blue Ravine Road	MIAD only	NA
COMMERCIAL / RETAIL	CR-2	North of intersection of East Natoma Drive and Green Valley Road	MIAD only	NA
COMMERICAL / UTILITIES	CU-1	Commercial – Utilities north of Folsom Lake Crossing	Phase 1 and 5	LT-6
RECREATION AREAS	RA-1	Boat Launch	Phase 1, 2, and 5	LT-8
INDUSTRIAL	I-1	Power Plant	Reference only	NA

Notes: NA = Reference only – no long-term monitoring conducted in these areas.

Receptor Type	Map ID (Figure 2-3)	Receptor Name, Location, and/or Address	Project Phase and Operation of Potential Concern	Long-Term Ambient Noise Monitoring Location ID
RESIDENTIAL	R-1	Lake Pointe Apartments	Phase 1 and 5	LT-6
RESIDENTIAL	R-2	Folsom Prison – North Buildings	All Phases	LT-1
RESIDENTIAL	R-3	Mountain View Drive Residences	All Phases	LT-3
RESIDENTIAL	R-4	Christina Court Residence	Phase 1, 2, and 5	LT-2 and LT-3
RESIDENTIAL	R-5	Lorna Lane Residences	Phase 1, 2, and 5	LT-2 and LT-3
RESIDENTIAL	R-6	Amaya Drive Residence	Phase 1, 2, and 5	LT-2
RESIDENTIAL	R-7	East Natoma Drive Residences	MIAD only	LT-4
RESIDENTIAL	R-8	Singer Lane Residences	MIAD only	NA
RESIDENTIAL	R-9	Ballau Circle Residences	MIAD only	LT-4
RESIDENTIAL	R-10	Church Grounds north of East Natoma Drive	MIAD only	NA
COMMERCIAL / RETAIL	CR-1	East Natoma and Blue Ravine Road	MIAD only	NA
COMMERCIAL / RETAIL	CR-2	North of intersection of East Natoma Drive and Green Valley Road	MIAD only	NA
COMMERICAL / UTILITIES	CU-1	Commercial – Utilities north of Folsom Lake Crossing	Phase 1 and 5	LT-6
RECREATION AREAS	RA-1	Boat Launch	Phase 1, 2, and 5	LT-8
INDUSTRIAL	I-1	Power Plant	Reference only	NA

EXPLANATION:

APPROXIMATE AREAS OF WORK (REFER TO MAIN DOCUMENT)

HAUL ROAD

R-10 SENSITIVE (RESIDENTIAL) RECEPTOR

CR-1 COMMERCIAL, INDUSTRIAL, OR RECREATIONAL RECEPTOR

GRAPHIC SCALE

1:15,000

100 0 100 200 500 1,000m

0 500 1,000 3,000 FT

US Army Corps of Engineers

Sacramento District

JOINT FEDERAL PROJECT
CONSTRUCTION OF THE CONTROL STRUCTURE AND LINING OF THE SPILLWAY CHUTE AND STILLING BASIN
SUPPLEMENTAL EA/IS

FIGURE 2-4

SITE MAP - SENSITIVE RECEPTORS AND PROPOSED AREAS OF WORK

W92138-09-D-0032

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DOUGLAS GRANT, P.G. FIG 2-3_Ver05MAY10

3.0 NOISE MODELING

Prediction of potential noise impacts within a specific area requires a series of interrelated calculations. The results of these calculations may be useful in determining the magnitude and extent of noise sources on ambient noise levels and environmental receptors. Computer-aided simulation programs have been developed to assist in the calculation process and properly assess complex systems of multiple noise sources, receptors, mitigating factors such as dense vegetation and terrain, ground absorption and reflection and other environmental factors. This methodology used is representative of engineering design projects and environmental studies routinely performed in California.

3.1 Noise Simulation Models

Four noise model applications were used for this analysis. These include simple screening-level noise modeling applications such as the Road Construction Noise Model (RCNM) and Traffic Noise Model (TNM) lookup tables used for predicting noise levels at various distances from construction equipment and traffic. For the proposed construction blasting, BNOISE2 was used. Modeling blast noise requires very different calculation algorithms specifically for high-energy, short-term or single-event noise sources. The USACE Construction Engineering Laboratory provided BNOISE2 for this project. BNOISE2 predicts peak noise levels associated with hundreds of types of explosives, charge size, depth of burial, and weather conditions.

For the majority of complex modeling required to accurately assess potential noise impacts related to this project SP7 was used. SoundPLAN 7™ has the ability to accurately calculate noise levels over a wide area while considering:

- Multiple noise sources and source type (point, area, and/or line).
- Sound power over multiple frequencies.
- Averaging predicted SPL over time using various assessment types.
- Atmospheric effects.
- Sound reflection from ground surfaces such as rock, asphalt, concrete and water.
- Sound absorption due to soft ground cover, dense foliage, and human-made structures.
- Effects of elevation and topographic features (3D terrain).
- Sound directivity and corrections based on impulsiveness, tonality, and hemispheric spreading.
- Sensitive receptor elevation and multi-story receptors.

Results from RCNM and BNOISE2 were used as noise source model input for SP7 in addition to SP7's extensive library of noise sources. Sound isopleth maps and cross-sections were then generated for the different construction activities proposed.

3.1.1 Noise Propagation and Model Input

SoundPLAN™ provides a choice of industrial propagation calculation standards and methodology. Each calculation method is internationally recognized and offers unique computer simulation techniques. International Standard of Organization (ISO) 9613-2006 was used for the simulations in this evaluation. ISO 9613 is a general purpose standard for outdoor noise propagation from “industrial” noise sources. Construction vehicles fall within this designation.

The model allows for site-specific and generalized development of the source, receptor, and environmental features. Individual noise source emissions are modeled as sound power levels and can be represented as a single center frequency (500 Hz), up to 30 one-third octave bands or 10 octave-band frequencies (31, 63, 125, 250, 500, 1,000, 2,000, 4,000, 8,000, 16,000 Hz).

Noise database libraries consist of emission sources with full or partial sound power spectra, absorption, and transmission loss by structural material type and attenuation. Geo-Data files allow for layering and reuse source types, time of use, and receptor geospatial locations (x, y, z coordinates), digital terrain models, buildings, structural acoustic characteristics (absorptive or reflective), and special features (terrain, ground cover, berms, sound walls, etc.). Use of the databases ensures consistent model input when evaluating multiple scenarios.

3.1.2 BNOISE2

The use of average noise levels over a protracted time period generally does not adequately assess the probability of community noise complaints. BNOISE2 was used to assess the risk of noise complaints from impulsive noise resulting from construction blasting, in terms of single event metrics. The metrics used were the peak sound pressure level [$P_{K\ 15}$(met)] and SEL using ANSI 12.9/4. The metric P_{K15} (met) accounts for statistical variation in received single event peak noise level that is due to weather. It is the calculated peak noise level, without frequency weighting, expected to be exceeded by 15 percent of all events that might occur. To account for normal (average) weather conditions the BN3.3 Weather Emulation was selected for the BNOISE2 calculations.

3.1.3 Road Construction Noise Model

The RCNM is a national model based on the noise calculations and extensive construction noise data compiled for the CA/T Project. The basis for the national model is a spreadsheet tool developed in support of the CA/T project. The CA/T predictions originated from U.S. Environmental Protection Agency (USEPA) noise level work and an Empire State Electric Energy Research Corporation Guide which utilizes an “acoustical usage factor” to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation. The noise levels listed represent the A-weighted L_{max}, measured at a distance of 50 feet from the construction equipment.

The RCNM was utilized to initially screen project construction noise for two phases; the phase with the greatest potential to generate noise, and the phase with the least potential. Due to the complexity of the large construction area, use of haul roads to off-site disposal/stockpile areas, variety of noise sources, severity of terrain, and the presence of elevated sensitive receptors located in the center of a majority of the proposed work, RCNM was found not suitable for accurate predictions of noise. Construction equipment sound power levels by octave-band frequency were used for noise sources in SP7.

For non-Type I projects, selective use of TNM 2.5 elements can be used to prepare a screening level assessment of existing traffic noise and the incremental increase in traffic noise due to project traffic additions to various road segments. Traffic noise is calculated over a 24-hour period (CNEL) or over hourly periods. To properly assess potential traffic increases due to time of day/night, the TNM 2.5 Lookup Table (LUT) was used. The methodology and results of the traffic noise are provided in Section 6.0.

4.0 NOISE CRITERION

The noise nuisance criterion is derived from local noise ordinances, state laws, and/or federal regulations/standards. These criteria and a description of the noise simulation model and the assumptions applied to determine noise levels at critical receptors are presented in these sections.

4.1 Regulatory setting

Federal regulations, standards, and guidelines, California state law, and local ordinances and regulations (LOR) pertaining to environmental noise are cited in this section. The LOR citations include all county ordinances and select city ordinances within the immediate Program Area. In addition, a representative selection of counties and cities throughout California that may be potentially treated are cited. Counties that do not have specific noise ordinances are either referenced as deferring to state or federal regulations, or if a noise element exists in a specific general plan, that element is cited.

4.2 Federal Standards

The federal noise standards or guidelines discussed in this section are applicable and relevant or to-be-considered during implementation of Program alternatives. Noise regulations and standards are provided for the following agencies:

- Department of Defense (DoD)
- U.S. Department of Transportation (DOT) – Federal Highway Administration (FHWA)
- U.S. Environmental Protection Agency (USEPA)
- National Environmental Policy Act (NEPA)

4.2.1 Department of Defense

The DoD has conducted extensive noise studies over the last 50 years. Noise Policy and Directives include "Being a Good Neighbor", complying with NEPA and the Federal Noise Act of 1972, monitoring noise exposure of threatened and endangered species, and avoiding Federal Tort Claims (DoD 2005). The emphasis of DoD noise policy relates to firing ranges, military training routes, and aircraft operations; however, blasting and heavy construction equipment operation by the USACE is relevant to this noise impact evaluation. The following table provides a guideline to predict complaints based on peak sound levels associated with blast noise.

Table 4-1: Peak Noise Level vs. Complaint Prediction Guidelines

Predicted Sound Level, dB_{Peak}	Risk of Complaints	Action
< 115	Low	No Restrictions
115 - 130	Moderate	Fire important tests. Postpone non-critical testing, if feasible.
130 - 140	High, possibility of damage.	Only extremely important tests should be fired.
> 140	Threshold for permanent physiological damage to unprotected human ears. High risk of physiological and structural damage claims.	Postpone all explosive operations.

4.2.2 U.S. Environmental Protection Agency (USEPA)

The USEPA has developed guidelines on recommended maximum noise levels to protect public health and welfare (EPA 1974). The USEPA does not enforce these regulations, but rather offers them as a planning tool for state and local agencies. The table below provides examples of protective noise levels recommended by the USEPA.

Table 4-2: USEPA Designated Noise Safety Levels

EFFECT	NOISE LEVEL	AREA
Hearing Loss	Leq (24)<70 dB	All areas
Outdoor Activity Interference and Annoyance	Ldn <55 dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	Leq (24)<55 dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor Activity Interference and Annoyance	Ldn <45 dB	Indoor residential areas
	Leq (24)<45 dB	Other indoor areas with human activities such as schools, etc.

Notes:
L_{eq} (24) = Represents the sound energy averaged over a 24-hour period.
L_{dn} = Represents the Leq with a 10 dB nighttime weighting.
Source: USEPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974.

4.3 State Noise Standards and Guidelines

State noise standards and guideline include CEQA, the California Department of Parks and Recreation General Plan, land use compatibility regulations and the California Vehicle Code. Elements of these are summarized below.

4.3.1 California Environmental Quality Act (CEQA)

Under CEQA, a substantial noise increase may result in a significant adverse environmental effect and, if so, must be mitigated or identified as a noise impact for which it is likely that no, or only partial abatement measures are available. Specified economic, social, environmental, legal, and technological conditions may make additional noise attenuation measures infeasible.

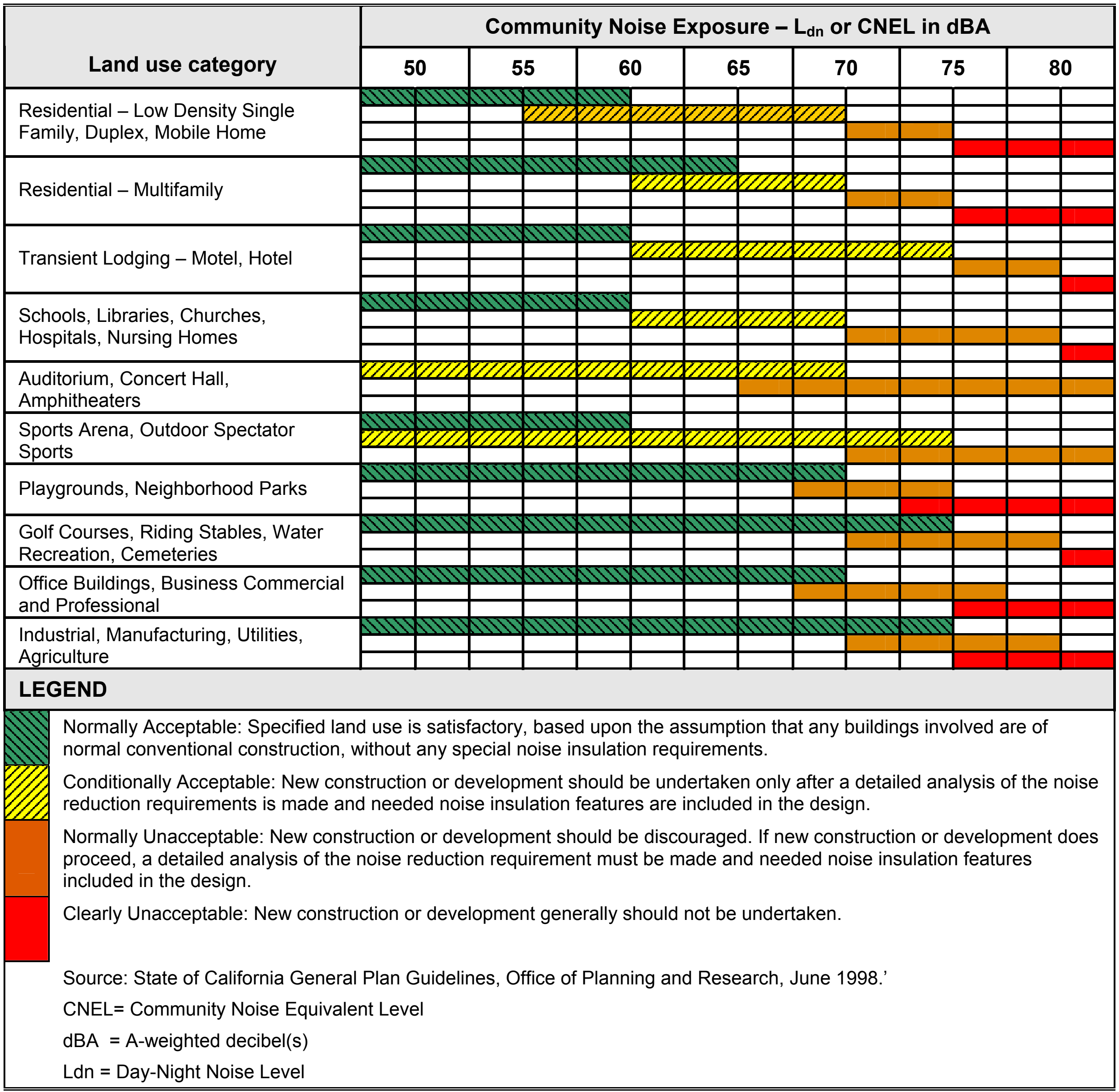
4.3.2 Department of Parks and Recreation General Plan

Statewide guidelines for General Plans published in 1998 indicate that levels under 70 L_{dn} should be acceptable to receptors in parks (OPR, 1998).

4.3.3 Land Use Compatibility

The California Government Code § 65302(f) encourages each local government entity to conduct noise studies and implement a noise element as part of their General Plan. In addition, the California Office of Planning and Research published guidelines for evaluating the compatibility of various land uses as a function of community noise exposure, and these are listed in Table 4-3 below. In general, noise levels less than 60 dBA L_{dn} are acceptable for all land uses, including residences, schools, and other noise-sensitive receptors. The State considers noise levels less than 70 dBA L_{dn} to be normally acceptable for playgrounds and neighborhood parks (OPR, 1998).

Table 4-3: Land Use Compatibility for Community Noise Environment



4.3.4 California Vehicle Code

Noise from highway vehicles and off-highway equipment is regulated by the Department of Motor Vehicles with cooperation from the California Highway Patrol. Off-highway motor vehicles manufactured between 1975 and 1986 must not exceed 86 dBA, and those manufactured after 1986 must not exceed 82 dBA when measured at 50 feet from the centerline of travel (Vehicle Code Section 38370). Heavy highway vehicles manufactured after 1987 must emit less than 80 dBA (Vehicle Code Sections 27204 and 27206).

For traffic noise, a change in noise levels of less than 3 dBA is not discernable to the general population. An increase in average noise levels of 3 dBA is considered barely perceptible, while an increase of 5 dBA is considered readily perceptible to most people (Caltrans 1998).

4.4 Municipal Noise Ordinance Requirements

The proposed project is located in the City of Folsom. Some traffic is expected through Sacramento County, Placer County, and El Dorado County, but noise impacts due to the expected traffic are not significant. The noise impact evaluation with respect to traffic will use the City of Folsom requirements as they are the strictest. Municipal ordinances for the three counties are provided in both the primary EA/IS and the previous Supplemental EA/IS for Early Excavation. All construction noise from the project will occur in the City of Folsom and Sacramento County. Therefore, noise ordinances pertaining to these municipalities are described below.

4.4.1 Sacramento County

The Sacramento County Noise Ordinance specifies noise levels in terms of L_{50}. Construction noise levels are exempt from 6:00 AM to 8:00 PM on weekdays and 7:00 AM to 8:00 PM on weekends. If construction were to occur outside of these periods, activities would be required to comply with exterior and interior noise limits at residential receptors, as summarized in Table 3-4. For impulse noise (such as impact pile driving or blasting), the limits are reduced by 5 dBA.

Section 6.68.120 of the Sacramento County Noise Ordinance states that, "it is unlawful for any person to operate any mechanical equipment installed after July 1, 1976 if the maximum noise level exceeds 60 dBA at any point at least one foot inside the property line of the affected residential property and 3 to 5 feet above ground level." Furthermore, equipment installed 5 years after July 1, 1976 must comply with a maximum limit of 55 dBA at the same distances within the property from the sound source. When measured from a distance of 50 feet, waste disposal vehicles and other similar vehicles or equipment cannot exceed 80 dBA on or after 5 years from July 1, 1976. Noise levels can not exceed the ambient level by 10 dBA or more at schools, churches or hospitals.

Table 4-4: Noise Ordinance Standards (Sacramento County)

			Noise Levels Not To Be Exceeded In Residential Zone**	
EXTERIOR NOISE STANDARDS	**Maximum Time of Exposure**	**Noise Metric**	**7 a.m. to 10 p.m. (daytime)**	**10 p.m. to 7 a.m. (nighttime)**
	30 Minutes/Hour	L_{50}	55 dBA	50 dBA
	15 Minutes/Hour	L_{25}	60 dBA	55 dBA
	5 Minutes/Hour	$L_{8.3}$	65 dBA	60 dBA
	1 Minute/Hour	$L_{1.7}$	70 dBA	65 dBA
	Any period of time	L_{max}	75 dBA	70 dBA
INTERIOR NOISE STANDARDS				
	5 Minutes/Hour	$L_{8.3}$	-	-
	1 Minute/Hour	$L_{1.7}$	-	-
	Any period of time	L_{max}	-	-

*Construction Noise Exemption Times: 6:00 a.m. - 8:00 p.m. Weekdays and 7:00 a.m. - 8:00 p.m. Weekends
**5 dBA reduction for impact noise during non-exempt times
Source: Sacramento County Municipal Code, Chapter 6.68.070.

4.4.2 City of Folsom

The City of Folsom uses L_{50} as the baseline criterion level. Construction noise is exempt from these regulations during the periods of 7:00 AM to 6:00 PM on weekdays and 8:00 AM to 5:00 PM on weekends. If construction were to occur outside of these periods, activities would be required to comply with exterior and interior noise limits at residential receptors, as summarized in Table 3-3. For impulse noise (such as impact pile driving or blasting), the limits are reduced by 5 dBA.

Table 4-5: Noise Ordinance Standards (City of Folsom)

			Noise Levels Not To Be Exceeded In Residential Zone**	
EXTERIOR NOISE STANDARDS	**Maximum Time of Exposure**	**Noise Metric**	**7:00 AM to 10:00 PM (day)**	**10:00 PM to 7:00 AM (night)**
	30 Minutes/Hour	L_{50}	50 dBA	45 dBA
	15 Minutes/Hour	L_{25}	55 dBA	50 dBA
	5 Minutes/Hour	$L_{8.3}$	60 dBA	55 dBA
	1 Minute/Hour	$L_{1.7}$	65 dBA	60 dBA
	Any period of time	L_{max}	70 dBA	65 dBA
INTERIOR NOISE STANDARDS				
	5 Minutes/Hour	$L_{8.3}$	45 dBA	35 dBA
	1 Minute/Hour	$L_{1.7}$	50 dBA	40 dBA
	Any period of time	L_{max}	55 dBA	45 dBA

*Construction Noise Exemption Times: 7:00 AM - 6:00 PM Weekdays and 8:00 AM - 5:00 PM Weekends
**5 dBA reduction for impact noise during non-exempt times
Source: City of Folsom, CA Municipal Code. Chapter 8.42, Table 8.42.040

4.4.3 Summary of LORs

The closest jurisdiction with the most restrictive noise level guidelines must be abided by. For the purpose of this project, the City of Folsom's standards will be followed because it is the closest jurisdiction with the most restrictive noise ordinance. The baseline criterion level (L_{50}) is 50 dBA during daytime and 45 dBA during nighttime. If this criterion is met within the City of Folsom, noise standards for other nearby jurisdictions will also be achieved. If the ambient noise level is above 50 dBA, then this becomes the new standard at each individual noise-sensitive receptor. For the City of Folsom, construction noise exemptions allow for noise generated by construction would not be subject to the exterior noise standard limits. These exempt times last from 7:00 AM to 7:00 PM during weekdays and 8:00 AM to 5:00 PM on weekends.

5.0 AMBIENT NOISE SURVEY

Ambient noise values are used in the impacts analysis to compare to noise sources and sound levels associated with the proposed project and to federal, state, and local ordinances and regulations (LOR) to determine whether proposed project activities would exceed established noise criteria

Extensive ambient noise data were obtained by URS in March 2009 to characterize existing noise conditions as part of the Early Excavation Supplemental EA/IS. The coverage of the ambient data monitoring encompasses the Control Structure and includes the Spillway Chute, Stilling Basin, Dike 7, Mormon Island Auxiliary Dam (MIAD), and the various import haul routes. The recency, completeness, quality, and overall coverage of these monitoring data make them applicable to this addendum. These data are included in this noise evaluation are considered baseline ambient noise conditions. The remainder of this section is directly quoted from the Early Excavation Supplemental EA/IS (2009).

The survey consisted of short-term (10 minutes) and long-term measurements (24 hours) at noise-sensitive receptors. Weather conditions were very consistent over the 3 days of noise monitoring. The temperature ranged from 55 degrees Fahrenheit at night to 75 degrees Fahrenheit during the day. Winds were mild and gusted to 6 or 7 miles per hour during noise monitoring. The long-term measurements were conducted using three Larson Davis Model 820 American National Standards Institute (ANSI) Type 1 integrating sound level meters (serial numbers 1527, 1528 and 1598). The sound level meters were bolted to trees, telephone poles or fences approximately 5 feet above the ground in order to approximate the height of the human ear. Short-term monitoring was conducted using an ANSI Type 1 integrating sound level meter (serial number 2672071). All sound level meters were calibrated before and after the measurement periods with a Larson Davis Model CAL200 calibrator (serial number 2794). All sound level measurements conducted by URS were in accordance with ISO 1996a, b, c.

The long-term and short-term measurement sites for human sensitive receptors are summarized in Table 5-1 and Table 5-2, respectively.

Table 5-1: Long-Term Measurement Sites

Location ID (1)	Location and Description	Modeled Receptor Equivalents
LT-1	Folsom State Prison	Folsom Prison Buildings
LT-2	Tacana Drive and East Natoma Street	R-4 (DIKE7-R-04) (2)
LT-3	Mountain View Drive	R-3 (DIKE7-R-01 to 06)
LT-4	East Natoma Street and Green Valley Road	R-9 and R-10 (MIAD-R-08 and 09)
LT-5	Shadowfax Court	Not Used
LT-6	East of Folsom Auburn Road and Pierpoint Circle	Lake Point Apartments 1-5 (R-1) Commercial-Utility Buildings 1-5 (CU-1)

Notes:
(1) No ambient measurements were recorded at LT-1 for security reasons.
(2) Figures may indicate either short-from receptor labels or the longer labels)

Long-Term Site Monitoring

Five long-term measurements were conducted. Long-term data was not collected at the Folsom State Prison for security reasons. The table below summarizes the long-term measurement site data. The raw data for each long-term measurement site are provided in Appendix A of the DS/FDR Early Excavation Supplemental EA/IS (2009).

Table 5-2: Long-Term Measurement Site Data

Site ID	Location	Start Date	Start Time	Hourly L_{eq} Range (dBA)	CNEL (dBA)
LT-1	Folsom State Prison	N/A	N/A	N/A	N/A
LT-2	Tacana Drive and East Natoma Street	3/25/2009	17:00:00	51.5 - 69.4	71
LT-3	Mountain View Drive	3/25/2009	15:00:00	32.8 - 50.9	50
LT-4	East Natoma Street and Green Valley Road	3/24/2009	14:00:00	58.0 - 75.2	76
LT-5	Shadowfax Court	3/24/2009	13:00:00	34.1 - 57.5	51
LT-6	East of Folsom Auburn Road. and Pierpoint Circle	3/24/2009	15:00:00	31.7 - 56.8	50

Notes:
Leq Equivalent noise level
CNEL Community Noise Equivalent Level
dBA A-weighted Decibel

EXPLANATION:

LT-8 LONG-TERM AMBIENT NOISE MONITORING LOCATION

APPROXIMATE AREA OF WORK (REFER TO MAIN DOCUMENT)

GRAPHIC SCALE
1:15,000

100 0 100 200 500 1,000m

0 500 1,000 3,000 FT

US Army Corps of Engineers
Sacramento District

JOINT FEDERAL PROJECT
CONSTRUCTION OF THE CONTROL STRUCTURE AND
LINING OF THE SPILLWAY CHUTE AND STILLING BASIN
SUPPLEMENTAL EA/IS

FIGURE 5-1
NOISE MONITORING LOCATION MAP

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6.0 IMPACTS ANALYSIS AND MITIGATION MEASURES

The noise impacts analysis compares predicted noise levels against the impact significance criteria presented in Section 6.2 below. Significant impacts are summarized for each project phase where one or more impacts were identified. A "no project alternative" was not evaluated due to the necessity of completing the current project.

For the purposes of this noise evaluation, the overall project was divided into specific phases. The phases are specific to probable and significant variations in noise model input and output. This is primarily due to terrain elevation changes, variable equipment types proposed, and the modeled locations of each piece of equipment. These phases may differ slightly from the project description, but adhere to major construction phases provided by the USACE.

Table 6-1: Construction Phase Activities and Figure Reference

Construction Phase	Description	Comments	Figure Reference
Off-Site Haul Routes (1)	Traffic Noise on Folsom Lake Crossing and Folsom Auburn Road (2)	80 Heavy Truck ADT and 70 Auto ADT	NA
Phase 1	Control Structure Excavation	See sub phases below	
Phase 1a	Blasting at Elevation 475'	Elevations vary between 470' and 480'	6-1, 6-1a
Phase 1b	Blasting at Elevation 350'	Approximately 25-30 feet above assumed final cut elevation of 325'	6-1, 6-1b
Phase 1c	Excavation after Blasting	After Phase 1a - Noisiest due to higher elevations compared to Phase 1b and 1c. Includes Haul Road and rock disposal at Dike 7 and MIAD	6-1c
Phase 2	Control Structure Foundation Work	Haul Road and coarse rock loading at Dike 7 and MIAD Stockpiling and Batch Plant operation at El. 480' on existing Overlook	6-2
Phase 3	Control Structure Gate Installation	Limited noise sources – single point sound (SPS) and RCNM screening used	6-3
Phase 4	Stilling Basin and Spillway Chute Foundation Preparation and Backfill	Modeled noise sources in and around the Stilling Basin (Worst Case)	6-4
Phase 5	Stilling Basin and Spillway Chute Concrete Placement	Haul Road and coarse rock loading at Dike 7 and MIAD Stockpiling and Batch Plant operation in the Spillway Chute at El. 340-345'	6-5
Phases 2 & 5	Batch Plant Locations	Comparison of Batch Plant located on peninsula and located in the Spillway Chute	6-6

Notes:
(1) Off-site Haul Routes for imported fill, aggregate, and rebar for foundation and other concrete work, and structural, mechanical, and electrical building components for the Control Structure (Phase 2, 3, 4, and 5).
(2) North of Folsom Lake Crossing.
MIAD Mormon Island Auxiliary Dam (disposal and course material stockpiling for USACE).

6.1 Noise Evaluation Assumptions

Elevations of the Spillway Chute and Stilling Basin are currently in final design modification, therefore the elevations used for modeled terrain and structures in this evaluation are conservative and provide "worst case" predicted noise levels at nearby receptors.

Noise impact modeling for blasting was based on an initial configuration that was relatively shallow, did not incorporate blast mats or blocking terrain between the blast area and sensitive receptors. The specifications were later refined to include blocking terrain, blast mats, and deeper borings. The total amount of explosive charge was increased due to closer spacing, but the initial modeling is considered a "worst case" scenario primarily due to the direct line-of-sight between the blast pattern and sensitive receptors along Mountain View Drive. The impacts and the mitigation measures remain the same for both blasting configurations.

The blasting configurations are as follows:

<u>Modeled Configuration:</u> Ammonium nitrate and fuel oil (ANFO) charges with a weight of 55- to 65-pounds per 5- to 10-foot deep hole on a 3-by-3-foot grid. A total of 9 charges with 30-foot spacing between each charge. No blast mats or blocking terrain between the blast grid and sensitive receptors. Two elevations were modeled; at approximate elevations 475-480 feet and 350 feet mean sea level (msl).

<u>Refined Configuration:</u> Charge weight of 44 pounds packed in 20-foot deep borings on 5-foot centers on a 20-foot-wide bench with no larger than a 75-foot wall. The wall serves as shielding terrain from a noise perspective. No more than 75 charges will be used. Blast mats will be placed over the charges.

Existing construction noise monitoring data were not available during the preparation of this report. Blasting and heavy construction work is currently in progress at the Spillway Chute and Stilling Basin, and dumping at Dike 7 is being conducted during construction-exempt hours between 7:00 AM and 7:00 PM.

Future operations will be conducted primarily during exempt hours. On limited occasions operations may begin before exempt hours and end in the evening after 7:00 PM. Comparing modeled construction noise to noise criteria during exempt hours is irrelevant, so evening and nighttime LORs were used for comparison. Therefore, references to predicted noise impacts will be limited to non-exempt hours.

6.2 Impact Significance Criteria

Impacts are considered adverse and significant if the project noise levels exceed field-monitored ambient noise levels and any of the following:

- LOR: City of Folsom and Sacramento County
- State of California: CEQA
- Federal: FHWA, NEPA, or USEPA

6.2.1 CEQA Significance Threshold

According to the CEQA Guidelines a project may be deemed to have a significant adverse impact on the environment if it would:

<u>Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.</u> Impacts to the proposed project would be significant if the new project elements exceed the existing standards.

<u>Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.</u> Impacts to the proposed project would be significant if the new project elements would create excessive ground vibration either by construction methods, blasting, or redistribution of heavy truck traffic.

Permanently and substantially increase ambient noise levels in the project vicinity above existing without the project. Impacts to the proposed project would be significant if the new project elements exceed the "substantial increase" criteria as set forth by Caltrans.

Temporarily or periodically increase ambient noise levels in the project vicinity above levels existing without the project. Impacts to the proposed project would be significant if the new project elements exceeded the construction noise ordinance or be considered "substantial" by Caltrans.

For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels. Impacts to the proposed project would be significant if the project places additional noise receptors within the existing flight operations area of adjacent airport.

6.2.2 LOR Significance Thresholds

For construction activities that will occur during non-exempt hours, the following City of Folsom and Sacramento County thresholds are applicable:

- From 10:00 PM to 7:00 AM: L_{50} of 45 dBA and L_{max} of 65 dBA.
- From 7:00 PM to 10:00 PM: L_{50} of 50 dBA and L_{max} of 70 dBA.
- L_{max} of 70-85 dBA in areas outside of City of Folsom jurisdiction.
- For traffic noise within the City of Folsom: L_{dn}/CNEL of 65 dBA.

6.3 Off-Site Traffic Noise Impacts and Mitigation

Projected traffic increases were evaluated for the project. Average Daily Trips were calculated and rounded up. The ADT used for traffic noise prediction are consistent with the traffic analysis. These values are 70 ADT for heavy trucks and 80 ADT for automobiles. The TNM 2.5 Look up Table was used as screening tool. The LUT calculates noise based on hourly traffic, so the ADT and percentage of daytime traffic by vehicle type were used to calculate hourly values. Four scenarios were modeled:

1. Current traffic noise during a daytime (i.e. "exempt") hour (Table 6-2).
2. Existing traffic and half of the project auto and heavy truck traffic occurring within a daytime hour (Table 6-2).
3. Existing traffic, all project autos and heavy truck traffic occurring within a daytime hour (Table 6-3).
4. Existing traffic, half of the project auto and heavy truck traffic occurring within a nighttime (i.e. "non-exempt") hour (Table 6-4).
5. Existing traffic, all project auto and heavy truck traffic occurring within a nighttime hour ("worst case") (Table 6-4).

Traffic data from the Early Excavation EA/IS study for Folsom Auburn Road and Folsom Lake Crossing were updated using a 3-percent yearly increase in ADT. Current heavy truck ADT counts correspond to the Early Excavation work currently in progress. The input parameters and results are provided in the table below:

Table 6-2: Traffic Noise, Current Daytime Hourly Traffic + Half of Project Traffic in a Daytime Hour

Road Segment	Current ADT and Hourly Daytime Traffic (1)	Current A-Weighted Hourly Equiv. Sound Level at 50'	Project ADT + ½ Current ADT by Daytime Hour	Projected Hourly Equiv. Sound Level at 50' (dBA)	Incremental Increase in dBA
Folsom Lake Crossing	15,250 / 1000	66.5	15,325 / 1,075	68.0	1.5
Folsom Auburn Road	29,700 / 2,550	72.5	29,770 / 2,625	72.9	0.4

Notes: Initial traffic data from DS/FDR Supplemental EA/IS (2009).
Breakdown of vehicle types during a daytime hour at:
Folsom Lake Crossing = 937 Autos, 17 medium trucks, and 45 heavy trucks.
Folsom Auburn Road = 1,931 Autos, 545 medium trucks, and 74 heavy truck.

Table 6-3: Traffic Noise, Current Daytime Hourly Traffic + All Project Traffic in a Daytime Hour

Road Segment	Current ADT and Hourly Daytime Traffic	Current A-Weighted Hourly Equiv. Sound Level at 50'	Project ADT + ½ Current ADT by Daytime Hour	Projected Hourly Equiv. Sound Level at 50' (dBA)	Incremental Increase in dBA
Folsom Lake Crossing	15,250 / 1000	66.5	15,400 / 1,150	69.0	2.5
Folsom Auburn Road	29,700 / 2,550	72.5	29,850 / 2,700	73.3	0.8

Table 6-4: Traffic Noise, Current Nighttime Hourly Traffic + All Project Traffic in a Single Night Hour

Road Segment	Current Hourly Nighttime Traffic (1)	Current A-Weighted Hourly Equiv. Sound Level at 50'	Project Hourly Traffic + Current Hourly Traffic by Nighttime Hour (1/2 / Full) *	Projected Hourly Equiv. Sound Level at 50' (dBA) (1/2 / Full) *	Incremental Increase in dBA
Folsom Lake Crossing	176	57.0	261 / 326	63.3 / 65.6	**6.3 / 8.6**
Folsom Auburn Road	391	63.0	466 / 541	67.2	**4.2**

Notes:
(1) Breakdown of vehicle types during a nighttime hour at:
Folsom Lake Crossing = 172 Autos, 3 medium trucks, and 1 heavy truck.
Folsom Auburn Road = 327 Autos, 63 medium trucks, and 1 heavy truck.
* Current hourly traffic + half of project traffic and current hourly traffic + all project traffic.

INCREASE IN AMBIENT NOISE

Incremental increases in traffic noise from the addition of project noise range from less than 1 dBA to less than 3 dBA. Small increases less than 3 dBA are typically not perceived. Additionally, traffic noise on both roads currently exceeds the City of Folsom's limitation of 65 dBA. Daytime impacts are less than significant. If all heavy trucks were to arrive and depart in a single hour after 10:00 PM and before 7:00 AM, when traffic and ambient noise levels are very low, impacts become significant as indicated on Table 6-4; however, since all project traffic is long-term temporary, no permanent noise increases will occur.

Impact N-1: Transportation of material and equipment from off site would temporarily increase local noise levels near sensitive receptors during nighttime or evening (Class II)

Mitigation Measure N-1a: Provide Advance Notices. Provide residents and businesses near the project advance notices of project activities, schedule, anticipated traffic, and potential noise issues. The advance notice shall describe the potential noise disruption and the steps the USACE or its contractor plans to take to minimize the noise (for example, by enclosing and muffling equipment, limiting idling and engine brake use).

Mitigation Measure N-1b: Provide Liaison and Hotline for Nuisance Complaints. In the event of complaints by nearby residents, the construction contractor shall monitor noise from construction activity. Noise shall be measured at the perimeter of the work area or adjacent to sensitive receptors. In the event that construction noise exceeds the specified limits prescribed by the USACE, the offending construction activity shall cease until appropriate measures are implemented. Optional: Noise thresholds shall be included in the construction contractor's contract with USACE.

Mitigation Measures N-1a and N-1b form the basis for public response to all noise impacts related to the proposed project. Both are referenced in the Impacts below.

Mitigation Measure N-1c: Heavy Truck Delivery Hour Planning. Attempt to schedule heavy truck deliveries during exempt working hours and whenever possible, avoid deliveries during a single hour, especially during non-exempt hours.

Mitigation Measure N-1d: Prohibit Engine Brake (Jake Brake) use within City Limits. Many noise complaints arise from heavy truck use of engine brakes to slow the truck down. This type of brake is secondary to the main braking system of a large truck, the air brake. Use of this type of braking can be avoided by proper speed control.

Mitigation Measure N-1e: Properly Maintain Equipment. The application contractor will properly maintain and tune engines of all application equipment and maintain properly functioning mufflers on all internal combustion engines to minimize noise levels. Perform noise reduction maintenance during routine maintenance for each vehicle serviced.

IMPACTS TO SENSITIVE RECEPTORS

Hauling and delivery operations have the potential to temporarily impact sensitive receptors. Quarry trucks and 18-wheel semi tractor trailers could cause short-term and temporary noise level increases if arrival and departure times are during non-exempt morning hours, or if all ADT occur during a single hour.

Significance after Mitigation: Less than Significant

6.4 Construction Noise Impacts and Mitigation Measures

Construction operations were evaluated by the five primary phases determined by USACE as described in the Project Description. Phase 1 was further subdivided for this noise analysis.

6.4.1 Phase 1: Control Structure Excavation

Four sub phases of the Control Structure Excavation were modeled and evaluated. These include blasting at three different elevations and excavation after the highest blast elevation. The phases include:

- Phase 1a – Blasting at Elevation 476 to 480 feet (146-148 meters). A single event within the footprint of the proposed Control Structure. Model is considered the "worst case" blasting scenario with direct line-of-site to sensitive receptors.
- Phase 1b – Blasting at Elevation 350 feet (106 meters). A single event approximately 20 feet above the assumed final grade of the Control Structure. Terrain blocks line-of-sight to nearby sensitive receptors. Based on the latest specifications, this is the more realistic of the two modeled blasting scenarios.
- Phase 1c – Excavation, Hauling, and Disposal. Removal of material after Phase 1a blasting.

Blasting Noise, Phases 1a and 1b:

Blast models were developed using BNOISE2 and SP7. Sound isopleth maps and cross-sections are presented individually and as a single figure for comparison.

INCREASE IN AMBIENT NOISE

Ambient noise levels will increase and then decay rapidly back to ambient levels over a short period of time. This period typically lasts several seconds and is the result of planned sequential firing of multiple charges. Since single-event noise very rarely exceeds the L_{dn} or CNEL, no adverse impacts to ambient noise levels are likely to occur.

No Adverse Impact

IMPACTS TO SENSITIVE RECEPTORS

Modeled L_{max} ranged from 50 to 72 dBA. The highest values predicted were at the closest buildings over looking the reservoir and construction site at Folsom Prison, or immediately north of Folsom Prison property (LT-1). The highest noise level (L_{max}) predicted at specific residences on Mountain View Drive ranged from 58 dBA to 61 dBA. However, since the PK15 unweighted noise level in the blast area is above 140 dB, vibration could cause minor annoyance to residents due to rattling windows or other structural building components.

Impact N-2: Blasting would cause vibration and noise causing potential startling and annoyance to nearby sensitive receptors (Class II)

Mitigation Measure N-2a: Notify the City of Folsom, and if necessary, nearby residents at least 72 hours in advance. Review previous noise monitoring results from blasting events during Early Excavation. Modify notification periods as necessary. Conduct blasting during exempt hours.

Mitigation Measure N-2b: Blast Location Planning. Where possible, plan blasting locations so existing terrain will shield blast noise. Blasting and excavating Lamb Chop Hill from west to east would shield nearby sensitive receptors located to the southeast for the majority of blasting operations. The current specifications require this.

Mitigation Measure N-2c: Utilize Blast Mats or other BACT. If the proposed charge size permits use of an available BACT to reduce noise and/or vibration, require the contractor to use them during blasting operations. The current project blasting specifications require this.

Significance after Mitigation: Less than Significant

Construction Noise during Excavation

This phase was selected for modeling as the elevations after initial blasting have a direct line-of-site to most sensitive receptors on all sides of the proposed area of work. Haul road travel by large dump trucks and rock disposal at Dike 7 and MIAD were also modeled as part of Phase 1c.

INCREASE IN AMBIENT NOISE

Ambient noise levels will increase during all excavation operations in Phase 1. Modeled L_{dn} noise levels at LT-3 were 70 dBA for all floors.

IMPACTS TO SENSITIVE RECEPTORS

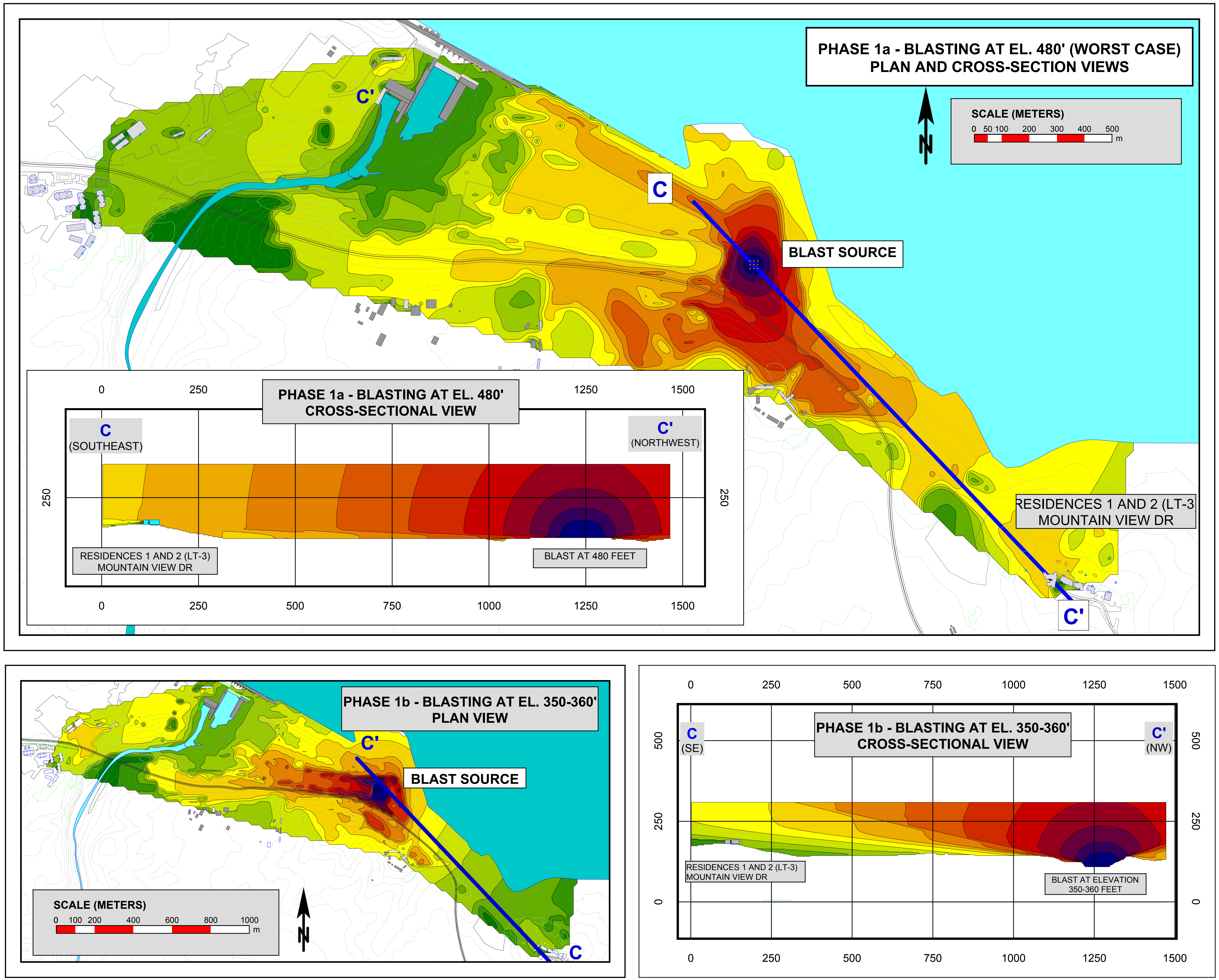
Several residences adjacent to Dike 7 may be significantly impacted by rock disposal in Dike 7. The worst case model used a front-end loader and belly dump truck unloading rock in the southeast corner of this site. Additionally, Haul Road noise was modeled as a line source over an 8-hour day using typical ingress-egress routing into and out of Dike 7. Any work performed during non-exempt hours will likely exceed LORs by up to 20-25 dBA.

Impact N-3: Dike 7 and MIAD rock disposal would cause loud impulsive noise at nearby sensitive receptors

Mitigation Measure N-3: Do not use Dike 7 or MIAD for Disposal during Non-exempt Hours.

See also: Mitigation Measures N-1a, N-1b, N-1d, N-1e, N-2a, and N-2b.

Significance after Mitigation: Significant but Mitigable



LEGEND

- BLAST CHARGE (ANFO 55-LB) x 9
- STRUCTURE
- RECEPTOR BUILDING
- OTHER CONCRETE STRUCTURE
- MITIGATION AREA - TREES/SHRUBS
- BRIDGE
- DAM FACE
- SOUND WALL
- GROUND ABSORPTION (ROCK)
- SENSITIVE RECEIVER
- CROSS-SECTION
- SECTION SUBSURFACE
- ELEVATION CONTOUR

PREDICTED NOISE LEVEL
L_{max}
in dB(A)

<= 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
100 - 105
105 - 110
> 110

NOTES:

BLASTING PATTERN: 3x3 GRID @ 30' O.C.
CHARGE TYPE: ANFO 55 LB PER HOLE
DEPTH: 5'-10' BGS
NO OTHER NOISE SOURCES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

JOINT FEDERAL PROJECT
DRAFT DS/FDR SUPPLEMENTAL EA/IS

FIGURE 6-1: SOUND ISOPLETHS IN PLAN AND CROSS-SECTION BLASTING SUMMARY BY PHASE

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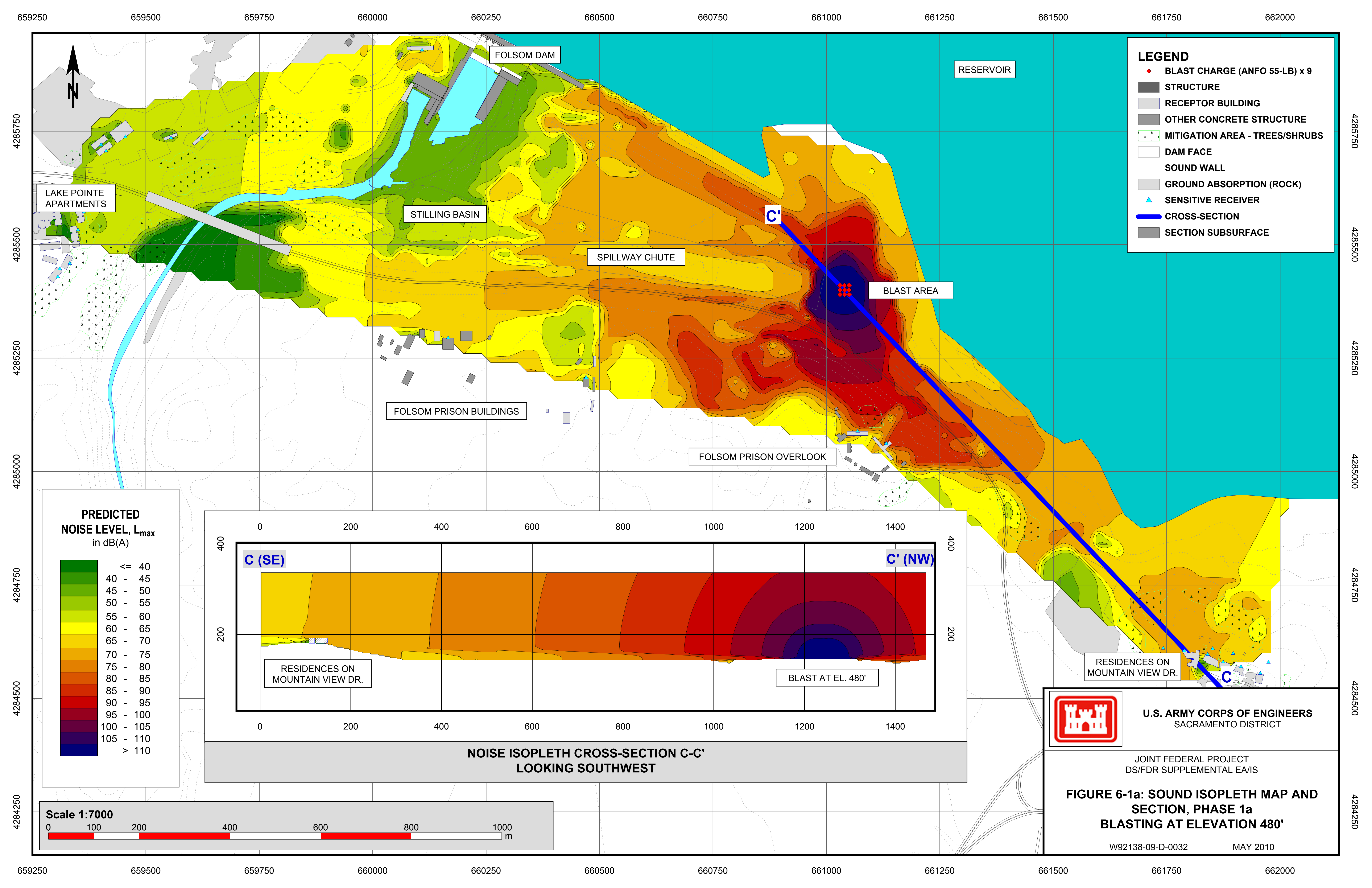
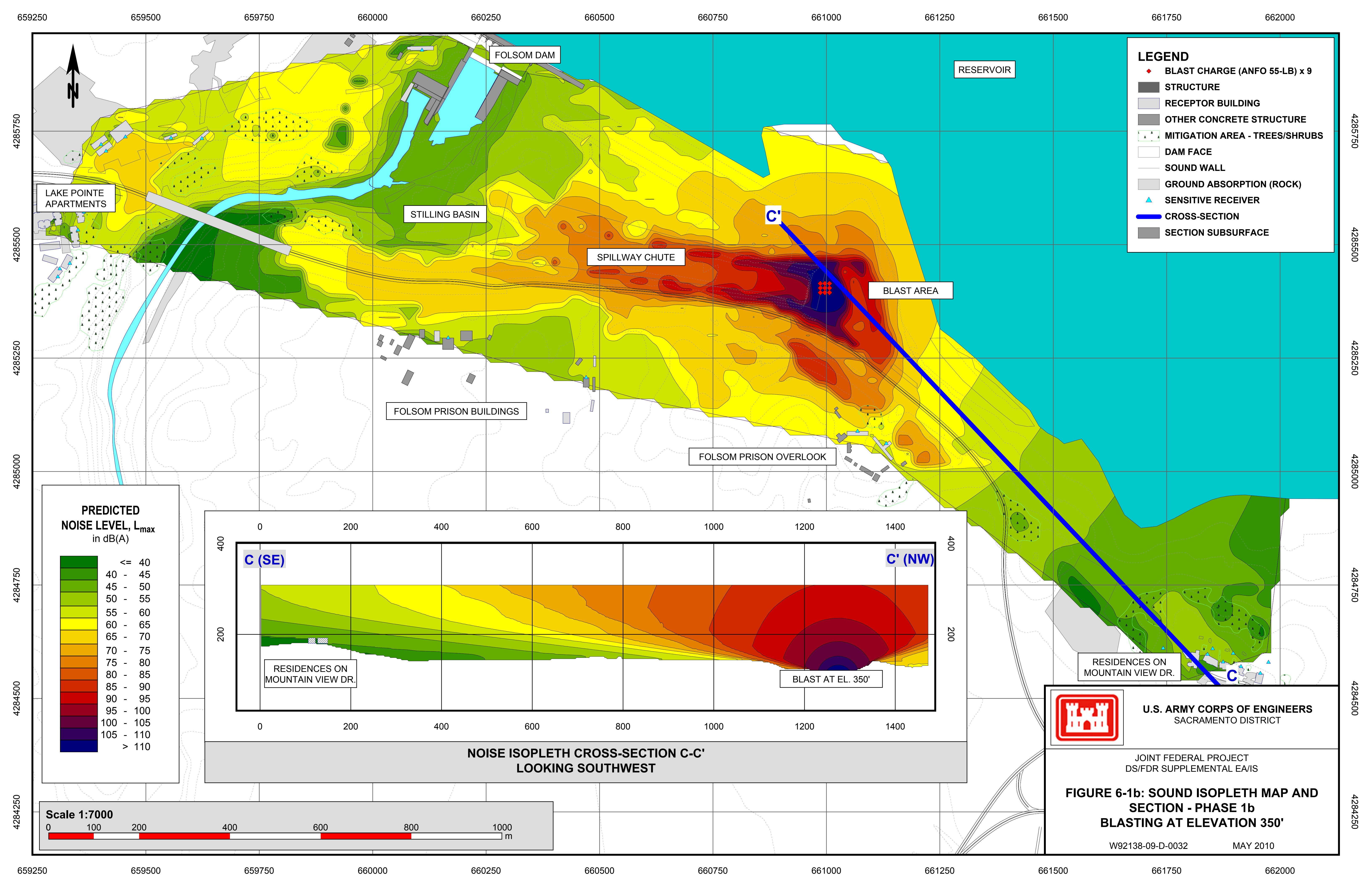


FIGURE 6-1a: SOUND ISOPLETH MAP AND SECTION, PHASE 1a BLASTING AT ELEVATION 480'



FOLSOM DAM
RESERVOIR
LAKE POINTE APARTMENTS
STILLING BASIN
SPILLWAY CHUTE
BLAST AREA
C'
C
FOLSOM PRISON BUILDINGS
FOLSOM PRISON OVERLOOK
RESIDENCES ON MOUNTAIN VIEW DR.
LEGEND
BLAST CHARGE (ANFO 55-LB) x 9
STRUCTURE
RECEPTOR BUILDING
OTHER CONCRETE STRUCTURE
MITIGATION AREA - TREES/SHRUBS
DAM FACE
SOUND WALL
GROUND ABSORPTION (ROCK)
SENSITIVE RECEIVER
CROSS-SECTION
SECTION SUBSURFACE
PREDICTED NOISE LEVEL, L_{max} in dB(A)
<= 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
100 - 105
105 - 110
> 110
C (SE)
C' (NW)
RESIDENCES ON MOUNTAIN VIEW DR.
BLAST AT EL. 350'
0 200 400 600 800 1000 1200 1400
NOISE ISOPLETH CROSS-SECTION C-C'
LOOKING SOUTHWEST
Scale 1:7000
0 100 200 400 600 800 1000 m
659250 659500 659750 660000 660250 660500 660750 661000 661250 661500 661750 662000
4285750 4285500 4285250 4285000 4284750 4284500 4284250
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
JOINT FEDERAL PROJECT
DS/FDR SUPPLEMENTAL EA/IS
FIGURE 6-1b: SOUND ISOPLETH MAP AND SECTION - PHASE 1b BLASTING AT ELEVATION 350'
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MAY 2010

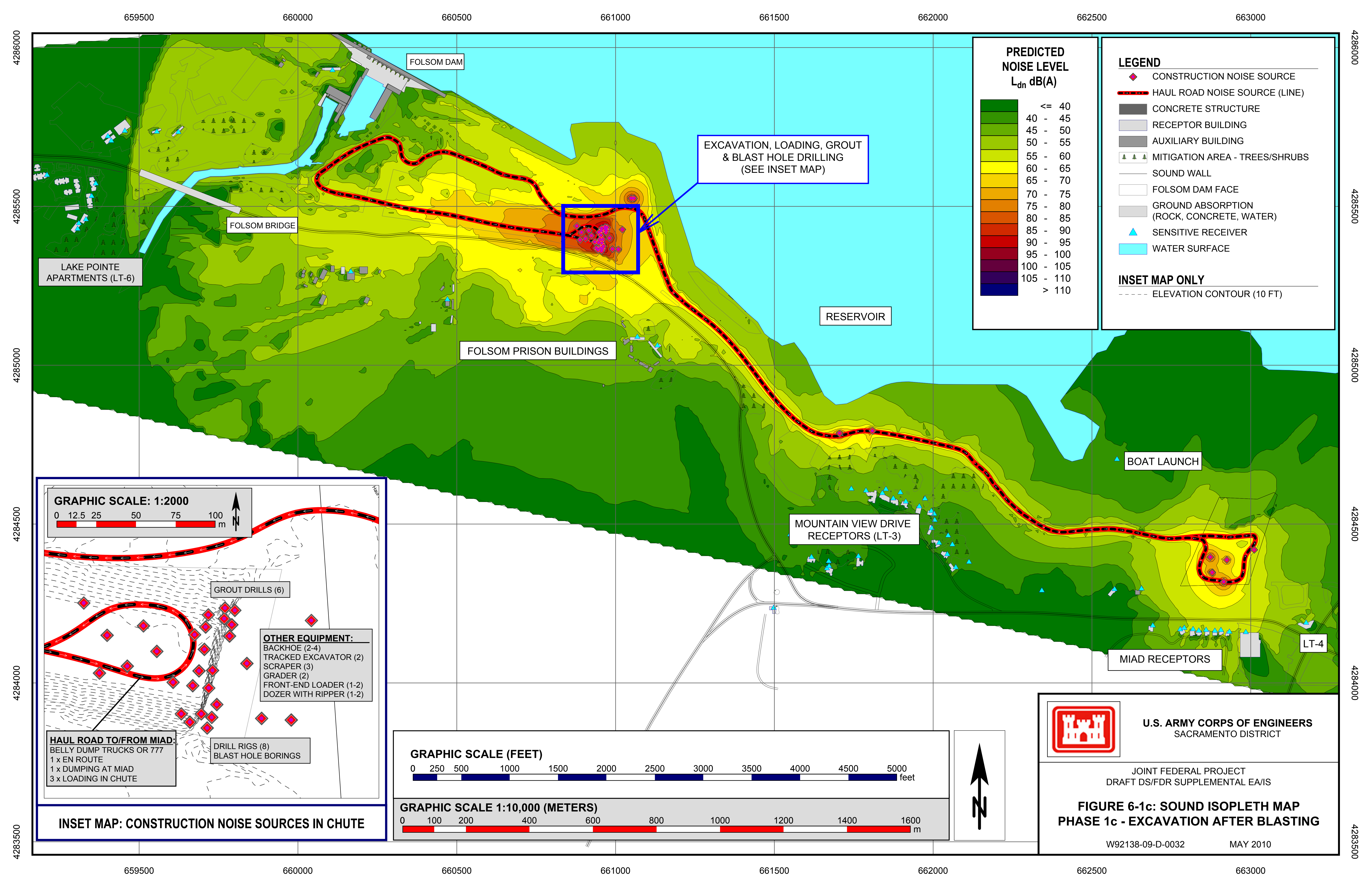


FIGURE 6-1c: SOUND ISOPLETH MAP
PHASE 1c - EXCAVATION AFTER BLASTING

6.4.2 Phase 2: Control Structure Foundation and Concrete Work

Modeled noise sources include the concrete Batch Plant, Haul Road transport of coarse material from Dike 7 and MIAD by super dump trucks (Caterpillar 777 or similar), wheeled front-end loaders loading of coarse material (rock) into the super dump at Dike 7 and MIAD, and various cement mixing, curing, blowing, and pouring equipment/operations. The Batch Plant was modeled both top-side on the peninsula and in the Spillway Chute for comparison.

Increase in Ambient Noise

Ambient noise levels will increase during Phase 2 along the Haul Road, in Dike 7 and MIAD Disposal Areas and in the construction area by up to 10 dBA. See Figure 6-2.

Impacts to Sensitive Receptors

Several residences adjacent to Dike 7 may be significantly impacted by coarse material loading in Dike 7 and transport to the Batch Plant or aggregate stockpiles. The modeled situation is similar to that in Phase 1d except the front-end loader noise signature was changed to rock and gravel loading instead of disposal. Modeled L_{max} noise levels exceeded 70 dBA over 24 hours.

Impact N-4: Dike 7 and MIAD rock loading and transport to the Batch Plant would cause impulsive noise and high noise levels at nearby sensitive receptors (Class II)

Mitigation Measure N-4: Avoid using Dike 7 or MIAD for Coarse Material Loading during Non-exempt Hours.

Impact N-5: Stationary and Mobile Construction Equipment Noise would increase noise levels near sensitive receptors (Class II)

Mitigation Measure N-5a: Utilize Best Available Control Technologies. Minimize noise levels using BACT, including installation of temporary noise barriers, acoustical enclosures, and stack silencers

Mitigation Measure N-5b: **Utilize terrain features to reduce noise to acceptable levels wherever possible.** Locate the concrete batch plant in the Spillway Chute instead of topside

See also: Mitigation Measures N-1a, N-1b, N-1d, N-1e, N-2a, and N-2b.

Significance after Mitigation: Less than Significant.

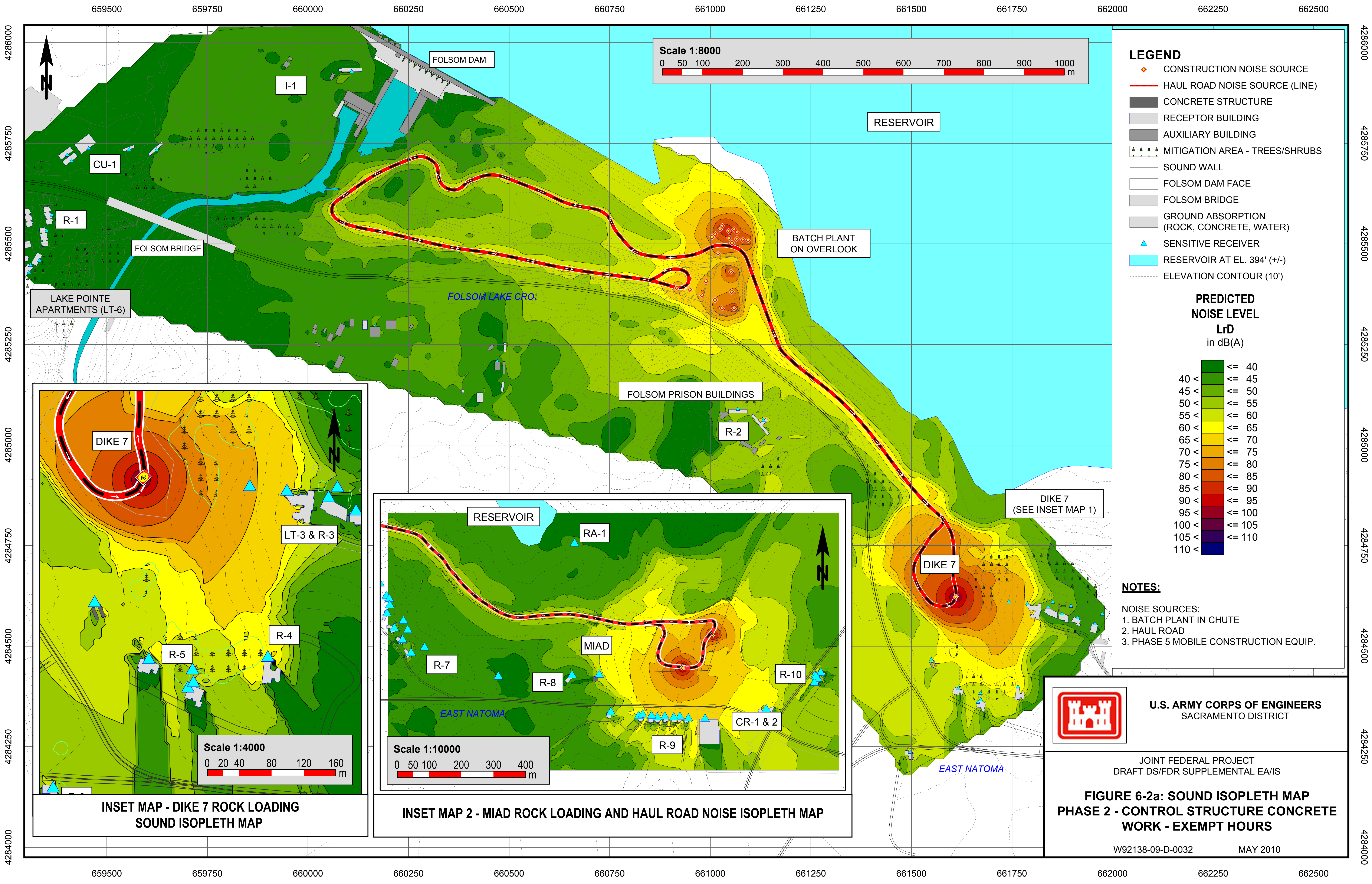
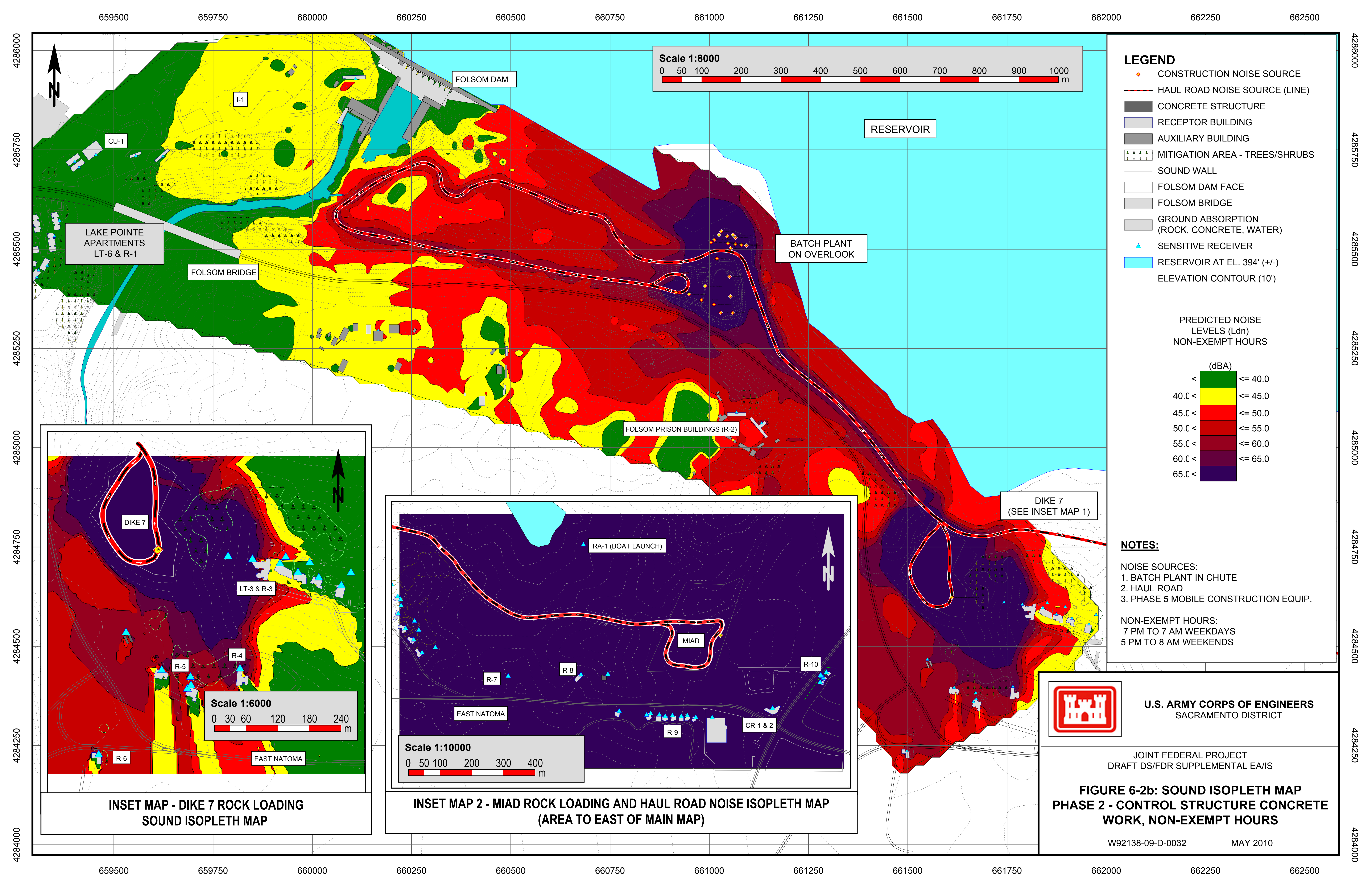


FIGURE 6-2a: SOUND ISOPLETH MAP PHASE 2 - CONTROL STRUCTURE CONCRETE WORK - EXEMPT HOURS



659500
659750
660000
660250
660500
660750
661000
661250
661500
661750
662000
662250
662500
4286000
4285750
4285500
4285250
4285000
4284750
4284500
4284250
4284000
N
Scale 1:8000
0 50 100 200 300 400 500 600 700 800 900 1000 m
FOLSOM DAM
RESERVOIR
I-1
CU-1
LAKE POINTE
APARTMENTS
LT-6 & R-1
FOLSOM BRIDGE
BATCH PLANT
ON OVERLOOK
FOLSOM PRISON BUILDINGS (R-2)
DIKE 7
(SEE INSET MAP 1)
LEGEND
CONSTRUCTION NOISE SOURCE
HAUL ROAD NOISE SOURCE (LINE)
CONCRETE STRUCTURE
RECEPTOR BUILDING
AUXILIARY BUILDING
MITIGATION AREA - TREES/SHRUBS
SOUND WALL
FOLSOM DAM FACE
FOLSOM BRIDGE
GROUND ABSORPTION
(ROCK, CONCRETE, WATER)
SENSITIVE RECEIVER
RESERVOIR AT EL. 394' (+/-)
ELEVATION CONTOUR (10')
PREDICTED NOISE
LEVELS (Ldn)
NON-EXEMPT HOURS
(dBA)
< <= 40.0
40.0 < <= 45.0
45.0 < <= 50.0
50.0 < <= 55.0
55.0 < <= 60.0
60.0 < <= 65.0
65.0 <
NOTES:
NOISE SOURCES:
1. BATCH PLANT IN CHUTE
2. HAUL ROAD
3. PHASE 5 MOBILE CONSTRUCTION EQUIP.
NON-EXEMPT HOURS:
7 PM TO 7 AM WEEKDAYS
5 PM TO 8 AM WEEKENDS
DIKE 7
LT-3 & R-3
R-4
R-5
R-6
EAST NATOMA
Scale 1:6000
0 30 60 120 180 240 m
INSET MAP - DIKE 7 ROCK LOADING
SOUND ISOPLETH MAP
RA-1 (BOAT LAUNCH)
MIAD
R-7
R-8
R-9
R-10
CR-1 & 2
EAST NATOMA
Scale 1:10000
0 50 100 200 300 400 m
INSET MAP 2 - MIAD ROCK LOADING AND HAUL ROAD NOISE ISOPLETH MAP
(AREA TO EAST OF MAIN MAP)
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
JOINT FEDERAL PROJECT
DRAFT DS/FDR SUPPLEMENTAL EA/IS
FIGURE 6-2b: SOUND ISOPLETH MAP
PHASE 2 - CONTROL STRUCTURE CONCRETE
WORK, NON-EXEMPT HOURS
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MAY 2010

6.4.3 Phase 3: Control Structure Construction and Gate Installation

This phase is relatively quite compared to all other phases. Screening level modeling was performed for the two tracked cranes using RCNM and single-point sound using SP7. Modeled noise levels at all receptors were less than 40 dBA. See Figure 6-3.

No adverse noise impacts.

6.4.4 Phase 4: Stilling Basin and Spillway Chute Foundation Preparation

Front-end Loaders, grout drills, tracked driver cranes portable cement mixers, and (assumed) cement blowers were qualitatively and quantitatively evaluated at the screening level. This phase is not expected to generate significant noise levels; therefore RCNM was used as an initial screening tool. Based on the RCNM results, more detailed modeling was performed for model correlation and to examine the effects of terrain, ground cover, and mitigative features such as dense vegetation and trees. Modeled L_{dn} noise levels at the Lake Pointe Apartment residential receptors ranged from 40 to 52 dBA. Ambient monitoring at LT-6 ranged from 31.7 to 56.8 dBA. Work conducted during non-exempt hours before 7 am may have a significant but mitigable impact on these receptors.

Impact N-5: Stationary and Mobile Construction Equipment Noise would increase noise levels near sensitive receptors (Class II)

Mitigation Measure N-5a: Utilize Best Available Control Technologies. Minimize noise levels using BACT, including installation of temporary noise barriers, acoustical enclosures, and stack silencers

Mitigation Measure N-5b: **Utilize terrain features to reduce noise to acceptable levels wherever possible.** Locate the concrete batch plant in the Spillway Chute instead of topside

See also: Mitigation Measures N-1a, N-1b, N-1d, N-1e, N-2a, and N-2b.

Significance after Mitigation: Less than Significant

6.4.5 Phase 5: Stilling Basin and Spillway Chute Concrete Placement

Potential impacts to all identified sensitive receptors were evaluated using SP7. Operational noise profiles for the Haul Road, Dike 7, and MIAD are identical to Phase 2 (single front-end loader each in Dike 7 and MIAD areas to load coarse material onto 777's for hauling back to aggregate stockpiles adjacent to the Batch Plant). Jack hammers, portable cement mixers and blowers, and equipment/operations similar to Phase 2 were modeled, with the loudest equipment at the Stilling Basin. The Batch Plant was modeled inside of the Spillway Chute. Figure 6-6 provides an illustrative comparison of noise model results for the Batch Plant located in the chute and located topside.

Modeled results for rock and course aggregate loading at Dike 7 and MIAD were the same as Phase 2. Predicted L_{dn} noise levels at the residences around Dike 7 with direct line-of-sight were over 65 dBA and up to 75 dBA. The L_{dn} noise levels were 1 to 2 dBA less than L_{max}, indicating that the noise levels would be consistently high based on the usage factors calculated from data provided by the USACE. Any work performed outside of the exempt hours would significantly increase ambient noise and impact the sensitive receptors around each area.

Impact N-6: Dike 7 and MIAD rock loading and transport to the Batch Plant would cause impulsive noise and high noise levels at nearby sensitive receptors (Class II)

Mitigation Measure N-6: Avoid using Dike 7 or MIAD for Coarse Material Loading during Non-exempt Hours.

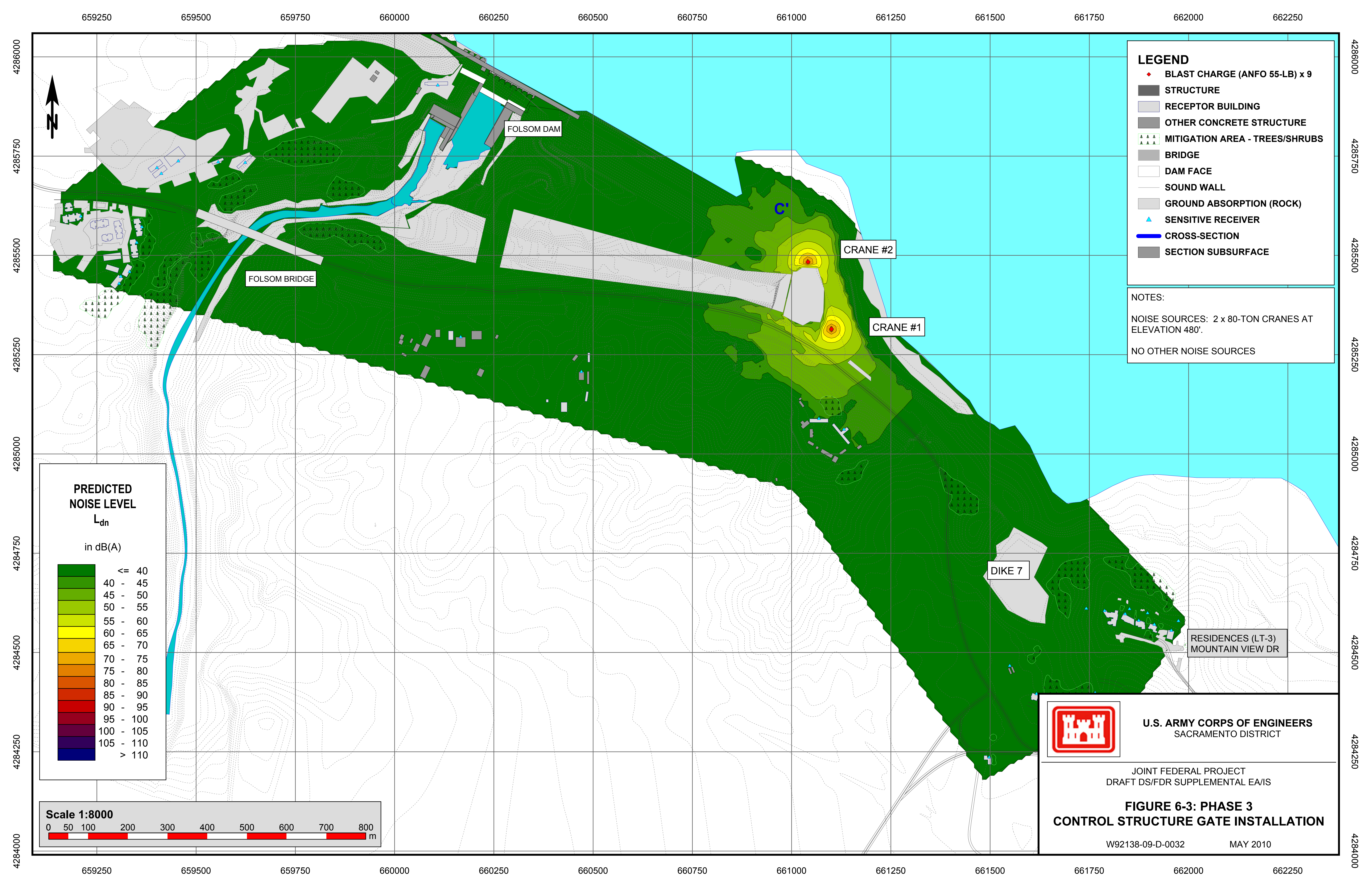
Impact N-7: Stationary and Mobile Construction Equipment Noise would increase noise levels near sensitive receptors (Class II)

Mitigation Measure N-7a: Utilize Best Available Control Technologies (BACT). Minimize noise levels using BACT, such as installation of temporary noise barriers, acoustical enclosures, and stack silencers

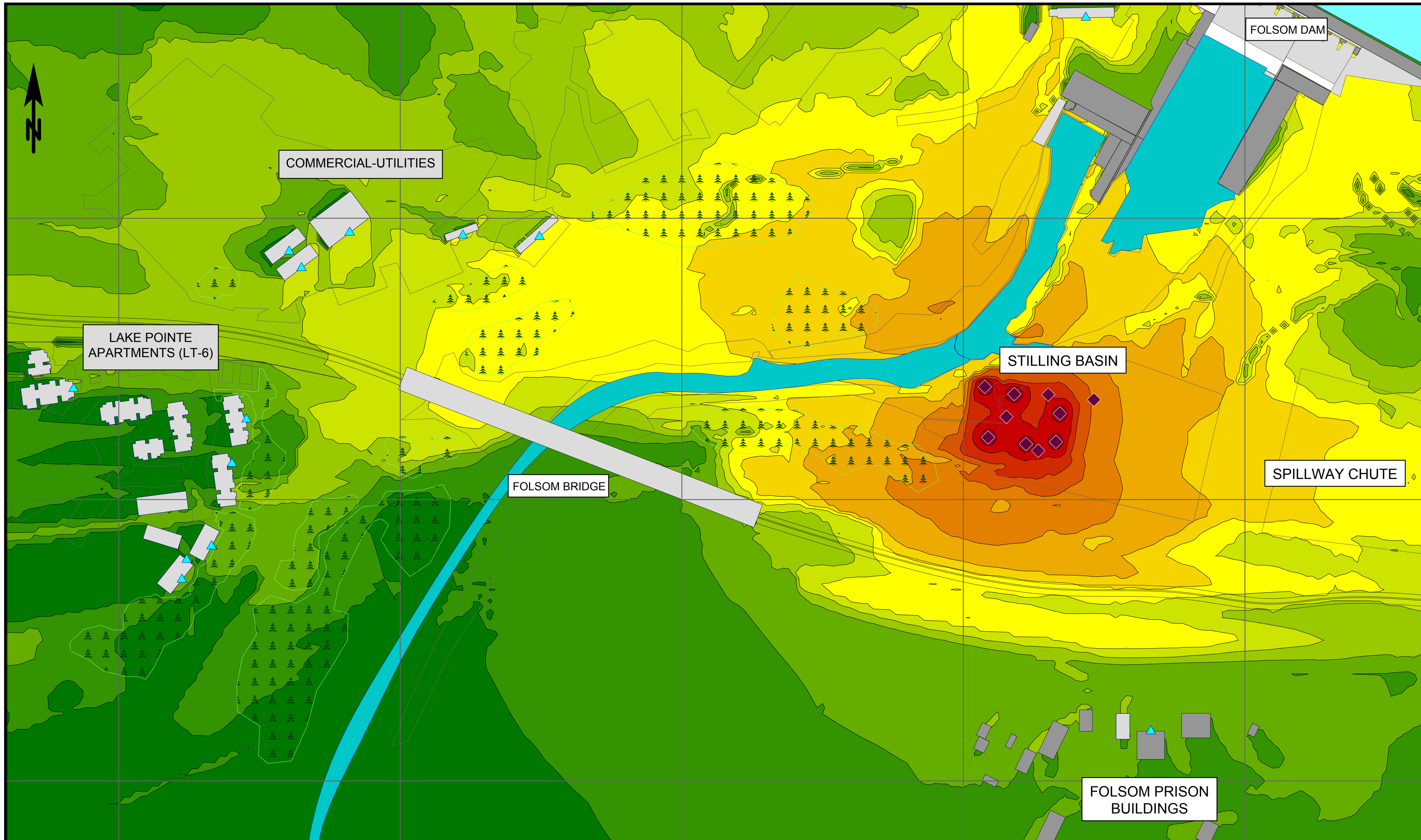
Mitigation Measure N-7b: Utilize terrain features to reduce noise to acceptable levels wherever possible. Locate the concrete batch plant in the Spillway Chute instead of topside

See also: Mitigation Measures N-1a, N-1b, N-1d, N-1e, N-2a, and N-2b.

Significance after Mitigation: Less than Significant.



LEGEND
BLAST CHARGE (ANFO 55-LB) x 9
STRUCTURE
RECEPTOR BUILDING
OTHER CONCRETE STRUCTURE
MITIGATION AREA - TREES/SHRUBS
BRIDGE
DAM FACE
SOUND WALL
GROUND ABSORPTION (ROCK)
SENSITIVE RECEIVER
CROSS-SECTION
SECTION SUBSURFACE
NOTES:
NOISE SOURCES: 2 x 80-TON CRANES AT ELEVATION 480'.
NO OTHER NOISE SOURCES
FOLSOM DAM
FOLSOM BRIDGE
C'
CRANE #2
CRANE #1
DIKE 7
RESIDENCES (LT-3)
MOUNTAIN VIEW DR
PREDICTED NOISE LEVEL
L_{dn}
in dB(A)
<= 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
100 - 105
105 - 110
> 110
Scale 1:8000
0 50 100 200 300 400 500 600 700 800 m
659250 659500 659750 660000 660250 660500 660750 661000 661250 661500 661750 662000 662250
4286000 4285750 4285500 4285250 4285000 4284750 4284500 4284250 4284000
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
JOINT FEDERAL PROJECT
DRAFT DS/FDR SUPPLEMENTAL EA/IS
FIGURE 6-3: PHASE 3
CONTROL STRUCTURE GATE INSTALLATION
W92138-09-D-0032
MAY 2010



No.	Receptor Name	Direction to Noise Sources	Level LrD [dB(A)]	Level LrDN [dB(A)]
1	Lake Point Apt Bldg 1 - 1st Floor	E	47.5	45.7
2	Lake Point Apt Bldg 1 - 2nd Floor	E	53.4	51.6
3	Lake Point Apt Bldg 2 - 1st Floor	E	42.3	40.6
4	Lake Point Apt Bldg 2 - 2nd Floor	E	51.5	49.8
5	Lake Point Apt Bldg 3 - 2nd Floor	SE	49.8	48.1
6	Lake Point Apt Bldg 3 - 1st Floor	SE	47.8	46.0
9	Lake Point Apt Bldg 5 2nd Floor	SE	48.5	46.7
10	Lake Point Apt Bldg 5 1st Floor	SE	46.8	45.1
11	Lake Point Apt Bldg 6 - 2nd Floor	E	49.1	47.4
12	Lake Point Apt Bldg 6 - 1st Floor	E	47.9	46.1
15	Commerical-Utilities West Building 01	SE	62.7	61.0
16	Commerical-Utilities West Building 02	S	59.1	57.4
17	Commerical-Utilities West Building 03	SE	56.0	54.2
18	Commerical-Utilities West Building 04	SE	55.2	53.5
19	Commerical-Utilities West Building 05	SE	45.0	43.3
20	Dam Control Building	S	60.7	58.9

Scale 1:4000

0 50 100 200 300 400 m

SITE LOCATION AERIAL

NO SCALE

LEGEND

- CONSTRUCTION NOISE SOURCI
- RECEPTOR BUILDING
- CONCRETE STRUCTURE
- DENSE TREES/SHRUBS
- SOUND WALL
- GROUND ABSORPTION (ROCK)
- SENSITIVE RECEIVER

PREDICTED NOISE LEVEL L_{dn}

in dB(A)

<= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 < <= 70
70 < <= 75
75 < <= 80
80 < <= 85
85 < <= 90
90 < <= 95
95 < <= 100
100 < <= 105
105 < <= 110
110 <

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FIGURE 6-4: SOUND ISOPLETH MAP
PHASE 4-STILLING BASIN FOUNDATION WORK

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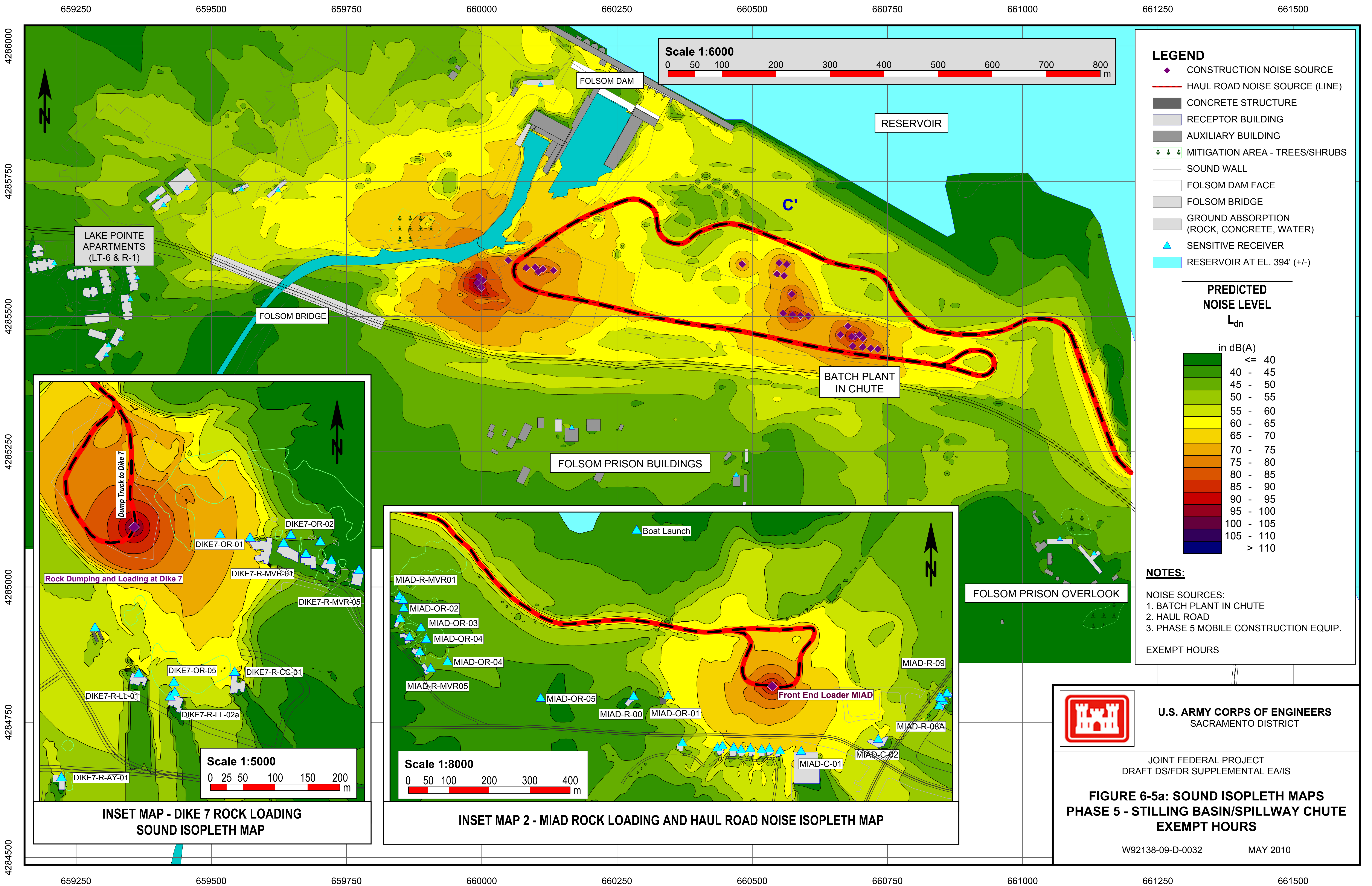

FIGURE 6-5a: SOUND ISOPLETH MAPS PHASE 5 - STILLING BASIN/SPILLWAY CHUTE EXEMPT HOURS

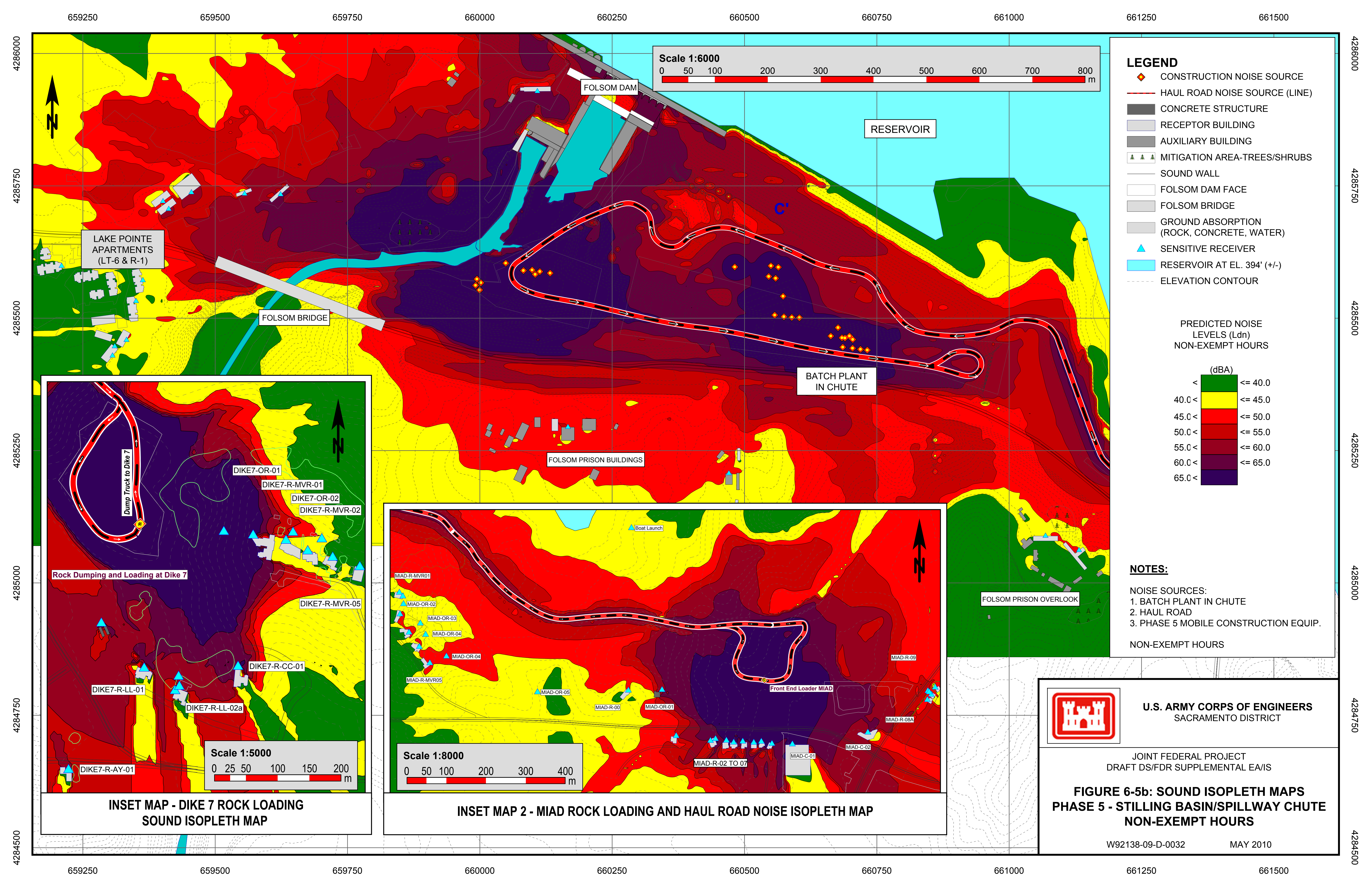

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FIGURE 6-5b: SOUND ISOPLETH MAPS
PHASE 5 - STILLING BASIN/SPILLWAY CHUTE
NON-EXEMPT HOURS

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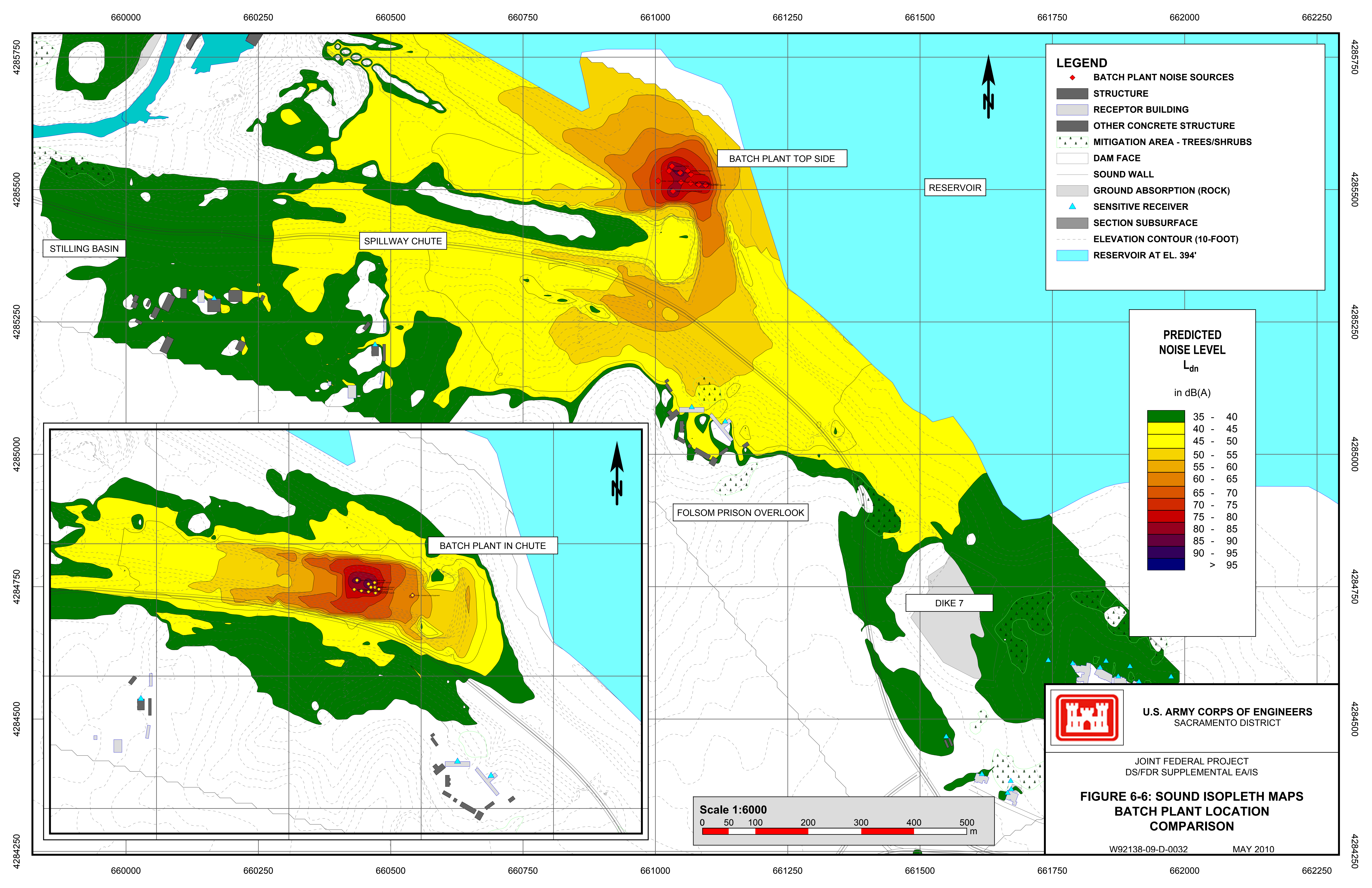

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FIGURE 6-6: SOUND ISOPLETH MAPS BATCH PLANT LOCATION COMPARISON

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Table 6-5: Summary Comparison of Noise Impacts[(1)]

Impact Statement	Off-Site Traffic	On-Site Construction							
		Phase 1a	Phase 1b	Phase 1c	Phase 1d	Phase 2	Phase 3	Phase 4	Phase 5
Noise									
Increases in Ambient Noise	**LS**	**N**	**N**	**N**	**LS**	**LS**	**SM**	**N**	**LS**
Impacts to Sensitive Receptors	**LS**	**SM**	**SM**	**SM**	**LS**	**SM**	**SM**	**N**	**SM**
Impact N-1: Transportation of material and equipment from off site would temporarily increase local noise levels near sensitive receptors during nighttime or evening hours	LS	na	na	na	na	na	na	na	na
Impact N-2: Blasting would cause vibration and noise causing potential startling and annoyance to nearby sensitive receptors.	na	SM	SM	LS	na	na	na	na	na
Impact N-3: Dike 7 and MIAD rock disposal would cause loud impulsive noise at nearby sensitive receptors.	na	na	na	na	SM	na	na	na	na
Impact N-4: Dike 7 and MIAD rock loading and transport to the Batch Plant would cause impulsive noise and high noise levels at nearby sensitive receptors.	na	na	na	na	na	SM	SM	na	na
Impact N-5: Stationary and Mobile Construction Equipment Noise would increase noise levels near sensitive receptors.	na	na	na	na	na	LS	LS	LS	na
Impact N-6: Dike 7 and MIAD rock loading and transport to the Batch Plant would cause impulsive noise and high noise levels at nearby sensitive receptors.	na	na	na	na	na	na	na	na	SM
Impact N-7: Stationary and Mobile Construction Equipment Noise would increase noise levels near sensitive receptors	na	na	na	na	na	na	na	na	SM

Key:
LS = Less-than-significant impact
N = No adverse impact
na = Not applicable
SM = Potentially significant but mitigable impact
SU = Potentially significant and unavoidable impact

Notes: (1) Construction noise is exempt from 7:00 AM to 7:00 PM on weekdays and from 8:00 AM to 5 PM on weekends. Noise impacts during these times are by definition "No adverse impact." Therefore, the values presented should be considered guidelines for adhering to the DoD's "Good Neighbor Policy" or for evaluating construction operations during non-exempt hours.

7.0 REFERENCES

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